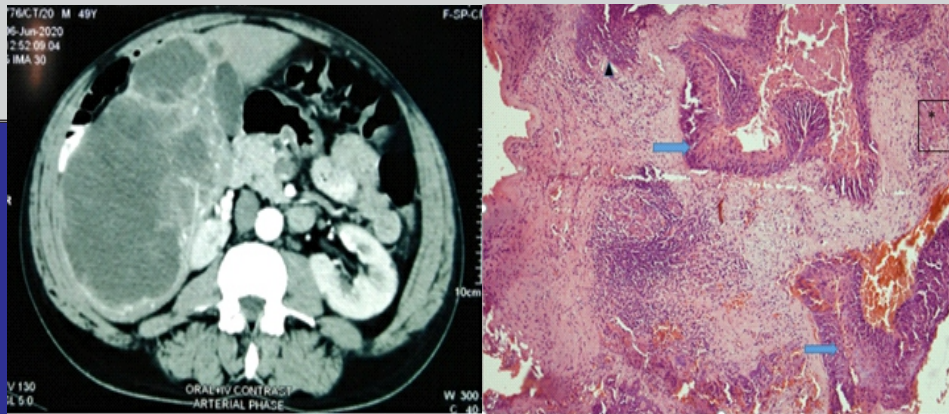




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- Cholangiocarcinoma in Sri Lanka - experience of a tertiary referral centre
- Job satisfaction among general surgeons and standards of surgical care
- Alvarado score in predicting acute appendicitis – a new cut-off value
- Open tibia fracture management : are we following current guidelines?
- Outcome of partial cystectomy for non-urothelial bladder malignancies

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The College of Surgeons of Sri Lanka
No.6, Independence Avenue
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Phone : 0094- 11 - 2682290
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Cholangiocarcinoma in Sri Lanka :experience of a tertiary referral centre

H S Perera¹, R G M S Nandasena¹, M D Jayawardene², B D Chandragupta¹, S Piyarathne¹, A A Pathirana¹

¹Department of Surgery, Faculty of Medical Sciences, University of Sri Jayewardenepura

²Professorial Surgical Unit, Colombo South Teaching Hospital, Kalubowila

Keywords: Cholangiocarcinoma; CA19-9; resectability; operability

Abstract

Introduction

Cholangiocarcinoma is a malignancy arising from the epithelial lining of the biliary tree, which is associated with a poor outcome.

Objectives

To describe the relative incidence of each type of cholangiocarcinoma, gender distribution, common presenting symptoms, the prevalence of metastatic disease and assess the resectability rates and to assess the relationship of different types of cholangiocarcinoma with CA19-9 levels.

Methods: A descriptive cross-sectional study, of patients diagnosed with cholangiocarcinoma, whose details were obtained from the hepato-pancreato-biliary database that is maintained in a tertiary care unit, in Sri Lanka. Quantitative variables expressed as the mean and standard deviation (SD) and qualitative variables expressed in percentages. The statistical analyses were carried out using SPSS version 25 with statistical significance defined as $P < 0.05$.

Results

One hundred and twenty patients ($n=120$) were studied. There was a higher incidence of cholangiocarcinoma among males. Average age of presentation was 61.8 years, with males presenting at a slightly older age. Hilar cholangiocarcinomas were the most common type, followed by distal and intrahepatic. Jaundice was the most common presenting symptom among distal and hilar cholangiocarcinomas. CA 19-9 levels were found to be elevated in 71.9% of the patients. Patients with hilar and intrahepatic cholangiocarcinomas had a higher incidence of advanced disease at the time of presentation with relatively low resectability rates observed among these patients.

Discussion

The demographic characteristics and the relative incidence of each type of cholangiocarcinoma was similar to those observed in the western world. However, we noted that the resectability rates in our study to be significantly lower in comparison.

Introduction


Cholangiocarcinoma is a malignancy arising from the epithelial lining of the biliary tree. Traditionally cholangiocarcinomas were classified as intrahepatic and extrahepatic tumours, with those arising proximal to the second order bile ducts being denoted as intrahepatic tumours. However, contemporary studies have shown that perihilar and distal cholangiocarcinomas which are separated at the point of insertion of the cystic duct, are unique in tumour biology [1], which has led to them being identified as distinct entities with individual staging, management protocols and prognostic parameters. Majority of the cholangiocarcinomas are adenocarcinomas, other histological types are also rarely seen.

While surgery remains the only potentially curative therapy, most patients are deemed to be unresectable due to advanced stage of the disease at the time of presentation [1], thus making cholangiocarcinoma a disease with poor outcome and high mortality. Traditionally a higher incidence has been noted among Asian populations as opposed to Europeans and North Americans [1]. Although the overall incidence is low in comparison to other malignancies, studies have shown that the incidence of cholangiocarcinoma, especially intrahepatic cholangiocarcinoma is steadily rising [2][3]. Intrahepatic cholangiocarcinoma is the second commonest primary hepatic malignancy following hepatocellular carcinoma [4], thus making it an important differential diagnosis which needs to be excluded in patients presenting with a malignant liver lesion.

Primary sclerosing cholangitis, inflammatory bowel disease, hepatolithiasis, choledochal cysts and biliary parasites are some of the recognized risk factors of cholangiocarcinoma, while smoking and alcohol are up and coming risk factors [5][6]. Recent studies have suggested hepatitis B & C, diabetes mellitus and obesity as potential risk factors [5][6].

Correspondence: H S Perera

E-mail: sahan_doc@yahoo.com

 <https://orcid.org/0000-0003-3973-1292>

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However, there is insufficient evidence to support this.

To date there has not been any studies describing the demographic and clinical characteristics of cholangiocarcinoma in Sri Lanka. While such a study is long overdue, it will not only provide as a source for surgical units in Sri Lanka to better understand cholangiocarcinoma, but also would provide a platform to build on and carry out further extensive studies, thus uplifting the standard of health care provision and benefiting the patients with cholangiocarcinoma in turn.

Materials and Method

The aim of this study was to describe the relative incidence of each type of cholangiocarcinoma, gender distribution, common presenting symptoms, the prevalence of metastatic disease and assess the resectability rates. The relationship between the CA19-9 levels with each subset of cholangiocarcinoma was also evaluated. CA19-9 level >100 U/L were more likely to have malignant aetiology and were considered as elevated for this study[7]. However, not all patients with extrahepatic cholangiocarcinomas had their biliary system decompressed prior to CA19-9 measurement, which was identified as a limitation.

Patients with cholangiocarcinoma, almost all of whom were diagnosed from January 2016 to March 2020, at a hepato-pancreato-biliary multidisciplinary team meeting in the presence of surgeons, radiologists, and an oncologist. Histological diagnosis was available only in those who underwent surgery and those who needed biopsy due to diagnostic doubt or when histology was needed prior to palliative chemotherapy. In majority the diagnosis was made radiologically with the aid of CECT and MRI/MRCP. This was identified as a limitation in the study. The characteristic CECT findings of intrahepatic Cholangiocarcinomas, capsular retraction, dilated bile ducts distal to the mass and delayed tumoral enhancement were used to distinguish it from hepatocellularcarcinoma. Details were obtained from the hepato-pancreato-biliary database that is maintained in the unit. While our study was restricted to patients presenting to and are followed up at our unit, it is important to note that our database comprised of patients from 13 districts (out of 25) in the country with majority from the Colombo (42%) and Kalutara (19%) districts.

Most of our study is descriptive in nature, with quantitative variables expressed as the mean and standard deviation (SD) and qualitative variables expressed in percentages. The statistical analyses were carried out using SPSS version 25 with statistical significance defined as P<0.05.

Results

There were 120 patients. Males accounted for 55% of the study population. The average age of presentation of cholangiocarcinoma was 61.8 years, ranging from 29 to 87. The average age of the male patients was 63 years, while that of the female patients was 60 years. The average age of presentation of distal, hilar and intra hepatic cholangiocarcinomas were 65.2, 61.4 and 57.2 years respectively.

Male patients accounted for 52.6%, 60.3% and 48% of distal, hilar and intrahepatic cholangiocarcinomas respectively.

Table 1. Patient characteristics

	Distal (n=39)	Hilar (n=55)	Intrahepatic (n=26)
Average age (years)	65.2	61.4	57.2
Male (%)	52.6	60.3	48
Female(%)	47.3	39.6	52

The relative incidence of distal, hilar and intrahepatic cholangiocarcinoma was 32.5%, 45.8% and 21.7% respectively. Of the hilar cholangiocarcinomas Bismuth Corlette type 2 accounted for 50% of the cases with types 3a, 3b and 4 accounting for the rest.

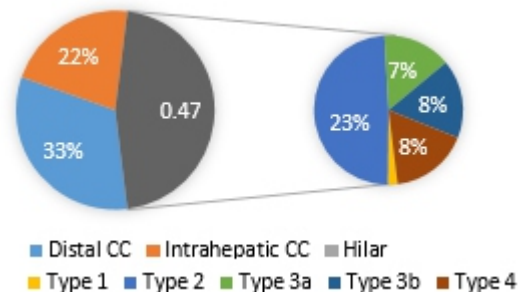


Figure 1. Incidence of each type of cholangiocarcinoma

Jaundice was the presenting symptom of majority of distal and hilar cholangiocarcinoma patients, 85% and 72% respectively. Less than 20% of the patients with intrahepatic cholangiocarcinomas were jaundiced at the time of presentation. Among patients with intra hepatic cholangiocarcinoma the most common presenting symptom was abdominal pain seen in 34.6% of the patients.

Table 2. Presenting symptoms

Symptom	Distal (n=39)	Hilar (n=55)	Intrahepatic (n=26)	Total (n=120)
Jaundice	33	40	5	78
Abdominal pain	0	0	9	9
Loss of appetite and weight	13	16	7	36
Fever/cholangitis	5	10	0	15
incidental	0	2	5	7

CA 19-9 levels were found to be elevated in 71.9% of the patients with cholangiocarcinoma. Elevated CA 19-9 levels were seen in 75%, 71% and 66.6% of the patients with intrahepatic, hilar and distal cholangiocarcinomas respectively.

The proportion of patients found to have metastatic disease at the time of presentation was 21%, 33% and 35% for distal, hilar and intrahepatic cholangiocarcinomas respectively.

Table 3. Metastatic disease

	Distal (n=8)	Hilar (n=18)	Intrahepatic (n=9)
Liver	3	12	0
Lung	2	2	4
Non-regional lymph nodes	1	2	3
Peritoneal	2	2	2

Of the patients with distal cholangiocarcinoma (n=39), 61.5% had resectable disease (n=24) at the time of presentation. However, only 50% (n=12) of these patients were deemed fit for surgery. Twelve patients underwent pancreateoduodenectomy and twenty-five patients underwent palliative metal stenting during this period.

Among the patients with hilar cholangiocarcinoma only 20% had resectable disease at the time of presentation. Only 27% of the patients with resectable disease were fit enough for surgery with two left and one right hepatectomy being performed in this period. Thirty-seven patients underwent palliative metal stenting.

Thirty-two percent (32%) of the patients with intrahepatic cholangiocarcinoma had disease amenable to resection at the time of presentation. All of them were deemed fit for curative therapy, with 2 left and 2 right hepatectomy, one non-anatomical liver resection and two locoregional therapy (1 TACE and 1 MWA) being performed. Eight patients were referred for palliative chemotherapy.

Table 4. Resectability and Operability

	DCC (n=39)	HCC (n=55)	ICC (n=25)
Unresectable	8 (20.5%)	37 (67.3%)	13 (52%)
Indeterminate	7 (18%)	7 (12.7%)	4 (16%)
Resectable	24 (61.5%)	11 (20%)	8 (32%)
a) Operable	12	3	8
b) Inoperable	12	8	0

Discussion

Males were the predominant gender among cholangiocarcinoma patients and they were found to present at an older age than females. Patients with distal and hilar cholangiocarcinomas were more likely to present at an older age in comparison to intra cholangiocarcinomas and this was statistically significant (p=0.02). While the gender distribution of distal cholangiocarcinomas (male-52%) and intrahepatic cholangiocarcinomas (male-48%) were relatively similar, males were the predominant gender in hilar cholangiocarcinomas (60%). However, this was not statistically significant (p=0.3). Hilar cholangiocarcinoma was the most common type of cholangiocarcinoma (45.8%), followed by distal (32.5%) and intrahepatic (21.7%) cholangiocarcinomas.

Patients with distal and hilar cholangiocarcinomas were more likely to present with jaundice, while those with intrahepatic cholangiocarcinomas were more likely to present with abdominal pain. Both these associations were found to be statistically significant (p<0.05). In a study by Forner et. Al, it was described that the most characteristic and common symptom of extrahepatic cholangiocarcinomas is jaundice. In the case of intrahepatic cholangiocarcinomas, jaundice is the initial symptom only in around 10%-15% of the cases, when biliary obstruction would mainly be related to obstruction of the liver hilum by lymph nodes or migration of detritus and subsequent failure of the correct drainage of the biliary ducts. When Cholangiocarcinoma patients present with symptoms others than jaundice, they most frequently include abdominal pain, malaise, night sweats, asthenia, nausea and weight loss.

CA 19-9 tumour marker levels were elevated in 71.9% of patients with cholangiocarcinoma. It was noted that the more proximal the malignancy the higher the probability of an elevated CA 19-9 levels however no statistical correlation was found for this association. In our study 46% of IHCC, 25% distal and 30% hilar cholangiocarcinoma had CA19-9 values more than 1000.

Patients with hilar and intrahepatic cholangiocarcinomas were more likely to have advanced disease at the time of presentation and this is reflected in the relatively low resectability rates of these patients in comparison to distal cholangiocarcinoma.

As studies on cholangiocarcinoma are sparse in Sri Lanka and within the South Asian region, we compared the results of our study with that of a similar study carried out by Nakeeb A, et al at The Johns Hopkins Medical Institutions, Baltimore, Maryland [8]. The demographic characteristics and the relative incidence of each type of cholangiocarcinoma is similar in both studies. However, we noted that the

Table 5. Our study compared to western published literature

	Our study	Nakeeb A, et al. Ann Surg 1996;224:463 ¹ The Johns Hopkins Medical Institutions, USA)
Overall Average age	61.8 years	62.2 years
Age range	29-87 years	23-84 years
Average age		
a) Distal	65 years	65 years
b) Hilar	61 years	62 years
c) Intrahepatic	57 years	59 years
Male %	55%	55%
Resectability		
a) Distal	61.5%	91%
b) Hilar	20%	56%
c) Intrahepatic	32%	50%

resectability rates in our study to be significantly lower in comparison.

While it is difficult to point out the exact reason for the low resectability rates in Sri Lanka in comparison to the western world, one can speculate that poor patient awareness of the disease, late presentation, inadequate resources (hence longer periods spent arriving at the diagnosis) and longer waiting lists as probable contributory factors.

Conclusions

Cholangiocarcinoma is a malignancy with poor outcomes and further studies need to be conducted at national level to ascertain its risk factors. There is a need to assess the survival rates of these patients and to determine the overall incidence of cholangiocarcinomas in comparison to other gastrointestinal malignancies. This will aid in broadening the knowledge of cholangiocarcinoma among the medical practitioners of Sri Lanka and will undoubtedly benefit the patients with this disease.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Job satisfaction among general surgeons and their perception of standards of surgical care provided within the health ministry structure in Sri Lanka

S A Hewage¹, M A C Lakmal², E M D N K Ekanayake², J A S B Jayasundara³

¹National Program for Tuberculosis Control and Chest Diseases, Ministry of Health and Indigenous Medical Services, Sri Lanka

²Colombo South Teaching Hospital, Kalubowila, Sri Lanka

³District General Hospital, Nuwaraeliya

Keywords: Job satisfaction; trauma care; Andrew-Whitney scale

Abstract

Introduction

A surgical career is challenging but provides opportunity for tremendous professional satisfaction. Research has shown that improved surgical infrastructure and human resources to be associated with better clinical outcomes, patient satisfaction and surgeons' job satisfaction. In Sri Lanka, general surgical services are predominantly delivered by surgeons employed by Ministry of Health (MoH).

Objectives

To assess the job satisfaction, perceptions on available facilities and quality of provided surgical services among general surgeons affiliated to MoH.

Method

A self-administered questionnaire based cross-sectional study evaluated the surgeons' opinion on adequacy of human resources and infrastructure at working institutions and the quality of provided care on elective general surgery, emergency trauma and emergency non-trauma surgical care. Job satisfaction was assessed using Andrew-Withey scale.

Results

The response rate was 49.4%(n=78). Majority of general surgeons were 'satisfied' (n=49,62.8%) or 'extremely satisfied' (n=7,9.0%) with their job while 15(19.2%) and 7(9%) were 'neutral' and 'unsatisfied' respectively.

Twenty-seven of 29(93.1%) Teaching Hospital(TH)-surgeons, 12/18(66.7%) of Provincial/District General Hospital(PGH/DGH)-surgeons and 17/31(71.8%) Base Hospital(BH)-surgeons were 'extremely satisfied' or 'satisfied' (p-value=0.004). Only 14 of 25(56%) domains assessing the adequacy of infrastructure and manpower had a positive response rate over 50% by participants. Many

believed the quality of elective general surgical care (n=67,89.3%) to be satisfactory than emergency non-trauma surgical care (n=55,70.5%) and trauma care (n=48,61.5%). Distribution of surgeons satisfied on trauma care within THs(n=22,75.9%) over PGH/DGHs(n=9, 50%) and BHs(n=17, 54.8%) was significant (p=0.015) in contrast to other service domains.

Conclusions

Overall majority of general surgeons were satisfied with their job with a significant proportion affiliated to THs. Many believed that available manpower and infrastructure to be suboptimal for ideal surgical care especially at BHs. Surgeons were satisfied on provided elective services than emergency and trauma care.


Introduction

Job satisfaction is a simple personal perception about ones' employment, but its' conceptual foundation has been complexly studied using various instruments [1]. Positive job satisfaction retains qualified workforce, achieves better productivity, delivers better customer-care and result in well-functioning organizations. Higher job satisfaction buffers against negative influences like employment-related stress [1]. A surgeons' career is demanding with many physical, psychological and spiritual challenges; yet it provides great rewards with tremendous personal and professional satisfaction [2]. However, the challenging nature of a surgical life may lead to substantial personal distresses to individuals and their families [3]. Professional stresses of a surgical life may contribute negatively, thus surgeons have a higher prevalence of burnout, psychiatric morbidity, and depression rates than the general population [4]. Studies have demonstrated strong associations between better working conditions for surgeons and patient satisfaction [4, 5]. Improved service delivery for surgical patients through improved infrastructure and human resources have led to better clinical outcomes, patient satisfaction and surgeons' job satisfaction [5-7]. Majority of studies on surgeons' job satisfaction are from developed countries.

Despite being a low-middle income country in the World Bank classification [8], Sri Lanka has a well-established state driven health care system. Ministry of Health and Indigenous

Correspondence: Bingumal Jayasundara

E-mail: bingumalj@gmail.com

 <https://orcid.org/0000-0002-6435-0734>

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Medical Services(MoH) is the main health care service provider. General surgeons are positioned-in from Type-B Base Hospitals to National Hospitals in MOH organizational structure. Due to ill-planned human resource management governed by non-updated decades-old government circulars [9], general surgeons working in the Base Hospital (BH)s and several District General Hospital (DGH)s are expected to cover both elective and emergency 'surgical' services that should ideally be provided by surgical sub/finer-specialties. This added burden has a potency to create a negative impact not only on quality of overall patient care, but also on general surgeon's job satisfaction. To the best of authors' knowledge, general surgeons' job satisfaction has not been studied in Sri Lanka before. In such a background, this study aims to assess the job satisfaction, perceptions on available facilities and quality of provided surgical care among general surgeons affiliated to MoH.

Method

This cross-sectional study was conducted among the general surgeons working at different hospital categories affiliated to the MoH, throughout Sri Lanka. A self-administered questionnaire containing five domains assessed the job satisfaction and the perception on delivered care. First domain evaluated the institutional availability of human resources and infrastructure required for proper functioning of a general surgical unit compared to the position paper developed by the Association of General Surgeons of Sri Lanka (AGSSL), summarized in Table-1. Second, third and fourth domains evaluated the General Surgeons' perception about the provided surgical care at his/her institution on elective general surgery, emergency trauma care and emergency non-trauma surgical care respectively. Fifth assessed the individuals' job satisfaction objectively using the Andrew-Withey(A-W) scale [1, 10]. Within the questionnaire, opportunity was provided to the respondents to reason out the answers to achieve qualitative assessment. The pre-tested questionnaire was posted to all Specialist General Surgeons affiliated to MoH to be returned anonymously. Data analysis was done using SPSS (version 21). Levels of job satisfaction, basic socio-demographic details and availability of infrastructure facilities and human resource were presented as frequency distributions. Associations between the surgeon's hospital category with the levels of overall job satisfaction and perception on provided services in elective surgeries, emergency trauma care and emergency non-trauma care were assessed using Chi square test.

Ethical clearance was obtained from the Ethical Review Committee of Sri Lanka Medical Association.

Results

Seventy-eight out of 158 board certified consultant general surgeons responded with a response rate of 49.4%. Twenty-nine of 48 (60.4%) TH surgeons, 18 of 48 (37.5%) PGH/DGH surgeons and 31 of 62 (50%) BH surgeons responded to the survey. Out of those responded, approximately similar percentages were employed at BHs (39.7%, n=31) and THs (37.2%, n=29). The remainder of 18 (23.1%) were employed at a PGH/DGHs. Majority of 47(60.3%) were between 45-55 years of age, while 17 (21.8%) and 14 (17.9%) were above 55 years and below 45 years respectively (Figure 1).

Among all participants, 7(9%) and 49(62.8%) had responded as 'extremely-satisfied' and 'satisfied' on their overall job satisfaction according to the A-W scale. Fifteen (19.2%) were 'neutral' and 7(9%) were 'unsatisfied'. Stratification of the overall satisfaction by the hospital type showed, 93.1%(n=27) of TH, 66.7%(n=12) of PGH/DGH and 71.8%(n=17) of BH general surgeons were to be either 'extremely satisfied' or 'satisfied' on their job. Distribution of 'extremely satisfied' or 'satisfied' general surgeons within the hospital categories were significant(p=0.004). Of the 7 'unsatisfied' general surgeons, one (14.3%) was employed at a TH and three (42.8%) each were placed at the other types of hospital categories (Figure 2).

Majority of participants, 66.7%(n=52) were confident to recommend his/her working position to a colleague. The percentage was significantly higher (p=0.029) among surgeons employed at THs-82.8%(n=24) compared to ones at PGH/DGHs (n=10, 55.6%) and BHs (n=18, 58.1%).

Perception on available facilities at the current working station

Table-2 and table-3 summarize the frequency distribution of the general surgeons who agreed on adequacy/availability of human resources and infrastructural facilities in their institutions respectively. Out of the 25 points questioned, 14(56.0%) had a positive response rate of 50% or more in overall evaluation. Positive response rate was highest among those at THs (96.0%), followed by PGH/DGHs (60.0%) and BHs (52.0%). Adequacy of junior surgical/anaesthetic staff, availability of specialist anaesthetic/radiological and surgical subspecialty support during weekends and adequacy of nursing and other support staff were the important points that had less than 50% positive responses in overall evaluation. In addition, availability of critical care and advanced radiology units and instruments were the vital points that had less than 50% positive responses. Percentage positive responses were higher in THs than BHs and PGH/DGHs.

Table 1. Minimum requirements need to be established to start a general surgical unit in a hospital

1	Wards	Separate male and female wards
2	Clinics	Minimum of one 4-hour clinic session per week
3	Operating Theatre	Minimum of 8 hours elective operating time per week
		Adequate time for emergency theatre time per workload
		Equipped with adequate instruments and supplies to handle casualties and a range of elective general surgical cases
		Laparoscope with basic instruments
4	Endoscopy facility	Fiber -optic upper and lower GI video-endoscope with facility for biopsy
5	Anaesthetic services	24-hour Anaesthetic cover, preferably with consultant supervision
6	ICU	Adequate number of ICU beds depending on hospital workload
7	Radiology	24-hour facility for plain radiography
		USS - 24-hour FAST facility and adequate elective ultrasonography facility
		CT - Access to CT scanning for elective and emergency cases
		Mammography - Access to Mammography facilities
8	Laboratory services	24-hour basic blood tests
		Access to hormone assays and blood culture
9	Blood Bank services	24-hour grouping/crossmatching and issuing of blood and blood products
10	Histopathology services	Access to histopathology and FNAC reporting, including urgent reporting for diagnosis of malignancies
11	Staffing	Adequate number of medical officers (Minimum of 4)
		Adequate nursing staff including for maintaining laparoscopic and endoscopic instruments
12	Accommodation	Quarters within easy reach to the hospital with electricity and water, to an acceptable standard for a consultant
		Accommodation to junior medical staff and on-call room facilities if on-site permanent accommodation is unavailable for all doctors

Table 2. Frequency distribution of positive responses on the adequacy/availability of human resources by the type of hospital.

	Number of General Surgeons agreed (%)			
	TH (n=29)	PGH/DGH (n=18)	BH (n=31)	Total (n=78)
1. Adequacy of junior surgical staff	23 (79.3)	4 (22.2)	9 (29.0)	36 (46.2)
2. Adequate availability junior anaesthetic staff	18 (62.1)	4 (22.2)	8 (25.8)	30 (38.5)
3. Availability of Consultant Anaesthetist (Weekdays)	29 (100.0)	13 (72.2)	22 (71.0)	64 (82.1)
4. Availability of Consultant Anaesthetist (Weekends)	20 (69.0)	5 (27.8)	4 (12.9)	29 (37.2)
5. Availability of Consultant Orthopaedic Surgeon (Weekdays)	25 (86.2)	4 (22.2)	6 (19.4)	35 (44.9)
6. Availability of Consultant Orthopaedic Surgeon (Weekends)	19 (65.5)	2 (11.1)	1 (3.2)	22 (28.2)
7. Availability of other surgical specialties (Urology/Neurosurgery etc.)	21 (72.4)	2 (11.1)	3 (9.7)	26 (33.3)
8. Availability of Consultant Radiologist (Weekdays)	28 (96.6)	13 (72.2)	24 (77.4)	65 (83.3)
9. Availability of Consultant Radiologist (Weekends)	18 (62.1)	3 (16.7)	3 (9.7)	24 (30.8)
10. Availability of adequate nursing/ non-medical staff	24 (82.8)	4 (22.2)	7 (22.6)	35 (44.9)

(TH- Teaching Hospital, PGH/DGH- Provincial/District General Hospital, BH- Base Hospital, ICU/HDU – Intensive Care Unit/ High Dependency Unit, FAST-Focused Abdominal Sonography in Trauma, CT- Computed Tomography)

Table 3. Frequency distribution of positive responses on the adequacy/availability of infrastructural facilities and resources by the type of hospital.

	Number of General Surgeons agreed (%)			
	TH (n=29)	PGH/DGH (n=18)	BH (n=31)	Total (n=78)
1. Availability of reasonable theatre facilities	17 (58.6)	10 (55.6)	24 (77.4)	51 (65.4)
2. Availability of adequate elective theatre time	16 (55.2)	11 (61.1)	25 (80.0)	52 (66.7)
3. Availability of adequate emergency theatre time	20 (69.0)	12 (66.7)	23 (74.2)	55 (70.5)
4. Availability of reasonable critical care facilities (ICU/HDU)	22 (75.9)	10 (55.6)	6 (19.4)	38 (48.7)
5. Availability of laparoscopic facilities	21 (72.4)	12 (66.7)	24 (77.4)	57 (73.1)
6. Availability of fiber-optic endoscopic facilities	22 (75.9)	17 (94.4)	26 (83.9)	65 (83.3)
7. Availability of adequate ward space	25 (86.2)	10 (55.6)	22 (71.0)	57 (73.1)
8. Availability of adequate clinic time	22 (75.9)	13 (72.2)	28 (90.3)	63 (80.8)
9. Availability of histopathology services	28 (96.6)	13 (72.2)	18 (58.1)	59 (75.6)
10. Availability of emergency X-ray/ultrasound scan/FAST 24*7	22 (75.9)	10 (55.6)	5 (1.61)	37 (47.4)
11. Availability of CT scan/ Mammography facility	25 (86.2)	3 (16.7)	5 (16.1)	33 (42.3)
12. Availability of 24 *7 basic laboratory facilities	23 (79.3)	11 (61.1)	29 (93.5)	63 (80.8)
13. Availability of blood/urine culture facility	29 (100.0)	11 (61.1)	22 (71.0)	62 (79.5)
14. Availability of 24 *7 functioning blood bank facilities	22 (75.9)	18 (100.0)	18 (58.1)	58 (74.4)
15. Availability of reasonable accommodation for the surgeon	12 (41.4)	13 (72.2)	20 (64.5)	45 (57.7)

(TH- Teaching Hospital, PGH/DGH- Provincial/District General Hospital, BH- Base Hospital, ICU/HDU – Intensive Care Unit/ High Dependency Unit, FAST-Focused Abdominal Sonography in Trauma, CT- Computed Tomography)

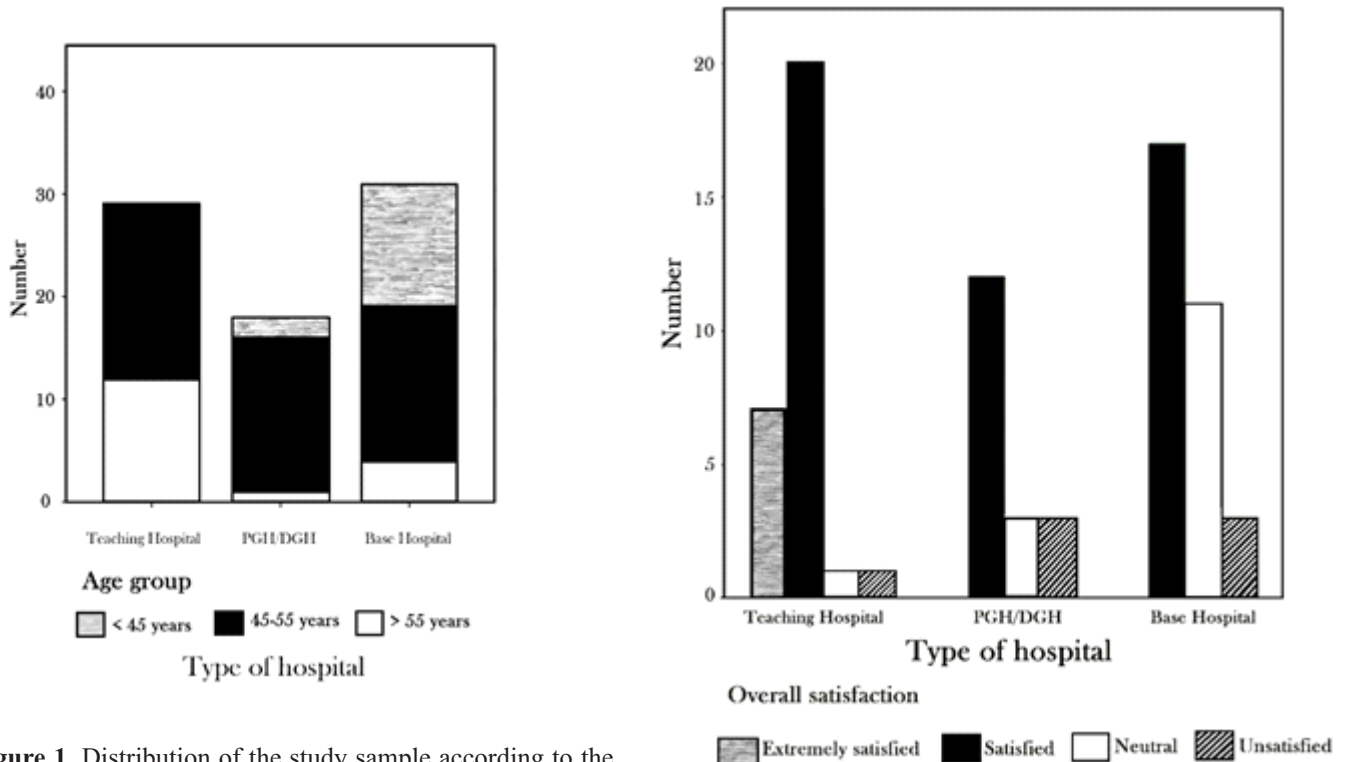


Figure 1. Distribution of the study sample according to the type of hospital employed, by age category (PGH/DGH – Provincial/District General Hospital)

Figure 2. Distribution of levels of overall satisfaction among the specialist general surgeons by the type of hospital (PGH/DGH – Provincial/District General Hospital)

Perception on elective general surgical care

Sixty-seven (89.3%) general surgeons believed to provide a satisfactory care for their patients during management of elective general surgical problems. The positive feedback percentage was higher among surgeons at THs (86.2%, n=25) and PGH/DGHs (100.0%, n=18) than surgeons at BHs (77.4%, n=24). Only 28(35.9%) general surgeons were satisfied with the available human resources for elective general surgery. Majority of these satisfied surgeons were from THs (58.6%, n=17), with similar proportions from PGH/DGHs (22.2%, n=4) and BHs (22.6%, n=7). On availability of surgical sub-specialists' (Orthopaedic, Urology, Neurosurgery etc.) support, TH general surgeons had higher percentage positive response (62.1%, n=18) than PGH/DGH (11.1%, n=2) or BH-surgeons (9.7%, n=3) ($p < 0.0001$). In the view of available non-surgical specialists' (Anaesthesia, Radiology, Pathology etc.) support in elective surgical care, 37(47.4%) respondents were satisfied. Among them, TH-surgeons (n=19, 65.5%) and PGH/DGH-surgeons(n=10,55.6%) were higher in percentage than BH-surgeons 8(25.8%) ($p=0.006$).

Only 30(38.5%) participants were satisfied with the available infrastructure facilities for elective surgery. TH-surgeons formed a significant majority of 17(58.6%) compared to surgeons at PGH/DGHs (n=4,22.2%) and BH (n=9,29.0%) ($p=0.017$). Majority believed that a better elective general surgical care could be provided at their institutions with improved human resources(n=59,75.6%) and upgraded infrastructure (n=60,76.9%). Further, 49(62.8%) were in the opinion that additional surgical and non-surgical specialists support would improve elective surgical care. Interestingly, 39(50.0%) responding general surgeons were happy to recommend the own station for a major elective surgery to a close relative, purely considering the available facilities. Distribution of this response across the THs(n=21,72.4%), PGH/DGHs (n=10,55.6%) and BHs(n=8,25.8%) was statistically significant($p=0.001$).

Perception on emergency trauma care

Considering quality of emergency trauma care delivered, 48(61.5%) general surgeons were satisfied over the standard of service provided. Surgeons at THs(n=22,75.9%) formed a significant majority of positive respondents than surgeons at PGH/DGHs(n=9,50.0%) and BHs(n=17,54.8%) (P-value=0.015). Only 24(30.8%) agreed on adequacy of human resources to manage major trauma at their institutions and again TH-surgeons(n=15,51.7%) formed the significant majority of positive respondents over PGH/DGH (n=3,16.7%) and BH(n=6,19.4%) surgeons (P-value=0.008). A minority 21(26.9%) agreed that the availability of surgical sub-specialists' (Orthopaedic, Neurosurgery etc.) support for

emergency trauma care is adequate, with a distribution among THs, PGH/DGHs and BHs of 11(37.9%), 5(27.8%) and 5(16.1%) respectively($p=0.005$). Nine (11.5%) surgeons specifically pointed out their unpleasant experiences on the support from centralized neurosurgical units in the managements of cases with severe head injuries. A little more than half of the study sample (n=43,55.1%) with almost equal percentage distribution between the hospital types, were satisfied over the available non-surgical specialists' (Anaesthesia/Radiology) support in trauma care at their hospital.

Only 21(26.9%) respondents were satisfied with the infrastructure for emergency major trauma care in their institutions. Surgeons at THs formed a significant majority (n=15,51.7%) compared to PGH/DGH(n=2,11.1%)-surgeons and BH(n=4,12.9%)-surgeons($p=0.001$). Majority of the general surgeons believed that they could provide a better trauma care at their institutions with improved human resources (n=58,74.4%) and upgraded infrastructure (n=67,85.9%). Further, 57(73.1%) were in the opinion that additional surgical and non-surgical specialists support would enhance the quality of trauma management. Only 24(30.8%) general surgeons felt assured for a close relative to have major trauma care at his/her hospital, purely considering the available facilities. This included 13(44.8%) employed at THs, 5(27.7%) at PGH/DGHs and 6(19.4%) employed at BHs ($p=0.007$).

Perception on emergency non-trauma surgical care

Fifty-five (70.5%) surgeons were satisfied with the quality of emergency non-trauma surgical care provided at their institution. This comprised of 21(72.4%) TH-surgeons, 13(72.2%) PGH/DGH-surgeons and 21(67.7%) BH-surgeons. Number of general surgeons who felt contented with the adequacy of available human resources for surgical emergencies was 33(42.3%). Almost similar to previous two surgical care categories, only 20(25.6%) surgeons were satisfied about the available surgical specialists' support during the management of non-trauma surgical emergencies. Fifteen (51.7%) TH surgeons were the substantial majority over 2(11.1%) PGH/DGH surgeons and 3(9.7%) BH surgeons ($p < 0.0001$). Only 20 (25.6%) were satisfied about the available hospital infrastructure for such management. Many believed that emergency non-trauma surgical care at their hospital can be enhanced by improved human resources(n=54,69.2%), better infrastructure(n=61,78.2%) and by additional specialists' support (n=46, 59%). Less than half of the study sample (n=36,46.2%) agreed they would recommend their working station for a close relative to have major non-trauma emergency surgical care considering the available facilities.

Discussion

MoH has a guidance over the hospital classification and expected level of care at each type of hospital [11, 12]. However, the minimum standard of infrastructure and human resources defined to each type of hospital has never been specified. Thus, in many instances, specialists including general surgeons are expected to deliver level of care comparable with world-expected norms with limited, insufficient and inadequate human resources and structural facilities. Such deficiencies in the working environment had shown to create a negative impact on ones' overall job satisfaction [3, 7].

Furthermore, in absence/limitation of trauma and other surgically treated disease registries, Sri Lanka does not have a validated island-wide system to retrieve patient outcome data. This has voided national indicators for surgical care in Sri Lanka. Additionally, due to lack of proper patient reported outcome data for surgical diseases, there is no quality assurance about the provided surgical care. With these factors, space for general surgeons to be satisfied and appreciated for the care they provide is limited. Present study details the service providers' perception on overall specialized general surgical care and job satisfaction within the MoH set up in Sri Lanka.

More than half the respondents expressed the inadequacy of human resources including surgical, anesthetic and nursing staff members. Inadequate supportive specialist categories required to provide surgical care (anesthesia/radiology) and surgical sub-specialties (orthopaedics/urology/ neuro-surgery) were raised as concerns in many institutions. These inadequacies were prominent during weekends and pronounced in BHs than the THs. Lack of elective theatre time was raised as a limitation by the TH- surgeons than the rest. Lack of critical care facilities was a prominent deficiency affecting BHs. In-house unavailability or lack of access of advanced imaging modalities (Computed Tomography/ Mammography) was another factor that disturb work performance of Bhs.

Understanding the work place deficiencies raised by the membership, AGSSL formed a minimum standard of requirements (human resources and infrastructure) needed for well-functioning of a general surgical unit in 2017 which was communicated to the MoH. This study evaluated the number/percentage of general surgeons satisfied with the adequacy of 25 domains of identified requirements, in accordance with that position paper. Unfortunately, there were 11 domains with less than 50% positive responses, suggesting the disappointment of general surgeons scattered around the country, on the available facilities. Insufficiencies were seen at every type of hospitals and were prominent in

BHs than PGH/DGHs and THs. Many BH-general surgeons pointed out, that the organizational misalignment between the line ministry and provincial government administrative structure as an important factor for this longstanding and ongoing problem.

Almost 90% of general surgeons were satisfied with the delivered elective general surgical services at their institutions. This was higher than the percentage of surgeons satisfied with the provided emergency trauma care (61.5%) and emergency non-trauma surgical services (70.5%). Lack of advanced radiological imaging for diagnosing and staging of diseases, lack of theatre facilities and critical care services were the main infrastructural deficiencies pointed by respondents that hamper elective surgical care. Irrespective of the deficiencies impeding the smooth delivery of elective general surgical care, many surgeons felt that they provide the maximum possible care. A few mentioned about the lack of commitment of the available staff and deficiency of team work as factors that need attention in order to improve the standard of elective surgical care. General surgeons' perception on the quality of provided emergency non-trauma care was similar to their perception on elective surgical services. The important additional consideration raised was the pronounced human resource (specialist and other staff) deficiencies during weekends.

According to the responding general surgeons, quality of delivered emergency trauma care was the least satisfied area of the surgical services. As detailed by a number of BH-general surgeons, their institutions lacked a dedicated 'accident and emergency' units. Lack of emergency X-ray/ trauma sonography facilities, deficiency of fulltime dedicated blood bank services and unavailability of intensive care units were the main physical deficiencies and the BHs were prominently affected. Almost all BH-surgeons had to manage orthopaedic trauma fulltime and several DGH-surgeons had to manage orthopaedic trauma during weekends. Many surgeons at BHs were in the opinion that the lack of specialist anesthetic support as a critical factor that compromise trauma care. Many general surgeons, mainly affiliated to BHs and DGHs raised the concerns over the management of patients with major head injury at their settings. According to them, lack of in-house advanced imaging facilities and transportation inadequacies have been delaying the anatomical diagnosis of head injuries. Number of general surgeons were pointing out on instances where centralized neurosurgical units not accepting cases with severe head injury. These events would have happened most probably due to infrastructural limitations at such units. As a result, there have been occasions where BH-general surgeons having to manage patients with severe head injury in ward settings. Lack of a proper trauma system with escalation criteria was identified

as an important island wide problem impeding a higher level of trauma care.

To the best of the authors' knowledge there are no previous studies on the job satisfaction of state sector general surgeons and their perception on the quality of delivered care in Sri Lanka. Further, there are no outcome studies on surgical diseases (including malignancies, other non-malignant diseases and trauma) at national or regional level, due to lack of centralized databases/registries in the country. Almost all available surgical outcome studies in Sri Lanka are from isolated research groups/units. Therefore, extrapolation of such results to the national level is not realistic and this information gap makes it difficult to correlate the outcomes of service provision with the available facilities. Couple of studies on major trauma outcome from the neighboring India have shown low overall survival outcome, when compared to the expected models of survival from western world [13, 14]. Insufficiencies in manpower and infrastructure have been postulated as important reasons for the suboptimal end results. Unavailability of national trauma registries to assess the magnitude of the problem leading to poor policy planning has been contributory to the meagre outcomes of major trauma care in India [14]. Similar comparisons of Sri Lankan trauma outcomes against the world accepted reference standards are not available. It is likely to be similar to the outcomes from the subcontinent due to similar socioeconomic background, infrastructural and human resource insufficiencies.

Conclusions and recommendations

The present study provides the perspective of the service provider on the quality of general surgical care delivered in Sri Lanka. Despite a higher proportion of responded general surgeons employed in the MoH being satisfied with their job, they have highlighted many deficiencies hindering the quality of delivered care. Low response rate among the general surgeons especially affiliated to the PGH/DGHs and BHs is a limitation of this study. Whether this lower response rate despite reminders itself, is an indirect measure of job dissatisfaction among the surgeons is unclear. Deficiencies were raised in emergency major trauma care than elective general surgery by the respondents. It is not practical to rectify all the said human resource and infrastructural deficiencies in each and every hospital at once. However, stakeholders need to have a long-term plan to develop the surgical facilities in already functioning hospitals, specially BHs and ill-equipped DGHs while implementing short/ intermediate-term plans to counteract the main shortages affecting the practice of safe general surgical care. In view of improving the service delivery to patients, following recommendations were suggested by the study participants for consideration of relevant authorities.

- Cadre expansions in order to provide adequate specialist and non-specialist medical cover, increasing the nursing and other supportive staff etc. needs to be performed with identified end points.
- Advanced radiological facilities and intensive care facilities needs to be expanded at least to the level of DGHs with regional BHs getting dedicated slots.
- There is a need to implement a proper trauma care system with dedicated regional level I trauma centers, thus BHs could function as level II trauma centers.
- Cluster on-call system may be arranged within nearby hospital groups, specially to cover weekends and to provide better work-life balance for the clinicians.

As suggested resolutions to overcome the service provision barriers are multidimensional, the authors recommend the MoH to liaise with all concerned parties to find out a long-lasting solution. Also, the MoH need to publish a minimum standard for surgical care at each level of hospitals and establish a system to monitor and ensure the said minimum standards are available at all times. In addition, professional bodies like College of Surgeons of Sri Lanka and the other surgical associations including AGSSL need to play an active role in the whole process to achieve a sustainable long-term solution to these complex and complicated problems affecting overall patient care.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Alvarado score in predicting acute appendicitis among patients presenting to a secondary care unit in Sri Lanka: a new cut-off value

Abeyasinghe G.B¹, Tennakoon S. U. B^{1,2}, Fahim H.M¹, Bandara R.M.S.N¹, Dassanayake G.K¹,
Dissanayake D.M.A.H¹

¹District General Hospital, Matale, Sri Lanka

²Department of community medicine, Faculty of Medicine, Peradeniya, Sri Lanka

Keywords: Alvarado score; appendicitis; cutoff; sensitivity; specificity

Abstract

Introduction

The commonest abdominal emergency in high and low-income countries is acute appendicitis. The lifetime risk is about 7%. The young age group is more susceptible, but none of the age groups is immune. As symptoms of acute appendicitis overlap with a few other conditions, accurate diagnosis is difficult. The objectives were to evaluate the sensitivity and specificity of the Alvarado score in the diagnosis of acute appendicitis among patients presenting with abdominal pain suggestive of acute appendicitis among Sri Lankan patients.

Materials and Methods

This was a validation study to determine the use of the Alvarado score for predicting the diagnosis of acute appendicitis at a General Hospital in the Central Province of Sri Lanka. All patients who were admitted to surgical units of General Hospital Matale with suspected acute appendicitis and undergoing appendectomy were the study population.

Results

A total of 178 patients were recruited for the study of which 83 were histologically confirmed cases and while 89 were not confirmed. The recommended Alvarado score cutoff of 7 returns a sensitivity of 62.5% and a specificity of 91%. On the other hand, a cut-off value of 4.5 provides a sensitivity of 89.2% and a specificity of 86.5%. This cutoff value increased the Negative Predictive Value to 89.5% from 72% whereas the Positive Predictive Value did not change.

Conclusions

An Alvarado Score cut off value of 4.5 provides a sensitivity of 89.2% and a specificity of 86.5% compared to 62% and 91% respectively at the recommended cutoff value of 7. Since calculating decimals is not practical with the score we suggest

lowering the cutoff of the Alvarado score to 5 for patients in Sri Lanka.

Introduction

The commonest abdominal emergency in high and low-income countries is acute appendicitis [1]. The lifetime risk is about 7% [2]. The young age is more susceptible but none of the age groups is immune. As symptoms of acute appendicitis overlap with a few other conditions, an accurate diagnosis of the condition is difficult. Various other factors such as late presentation and partial treatment make the diagnosis more challenging. Hence investigations may be needed to support the clinical diagnosis [3]. None of the available investigations is 100% diagnostic [4].

Apart from C-reactive protein and white blood cell count the other commonly used investigation modality is ultrasound scan; which is freely available but highly operator dependent in the diagnosis of acute appendicitis [5]. Contrast-enhanced, thin-section computed tomography scanning is the imaging modality of choice in achieving a diagnosis and detecting complications in acute appendicitis, with high specificity. But it is not freely available in our set up. Due to the above facts, many clinicians have proposed the use of clinical predictive rules [CPR] to enhance the clinical diagnosis of acute appendicitis. [6,7]. These CPRs utilise important symptoms, signs and test results in an attempt to quantify the probability of the disease being present [8]. CPR would allow junior medical officers to decide to either transfer or not transfer the patient to a better-equipped centre when they receive a patient with abdominal pain of which the aetiology is not clear. The Alvarado Score is the most used CPR in the diagnosis of Acute Appendicitis. Alvarado score, which was suggested by Alford Alvarado in 1986, consists of eight predictive factors to help in the early diagnosis of acute appendicitis [9]. The score is based on four symptoms, two signs and one laboratory investigation which translate to a total score of 10 points [Table 1]. Based on this score, three groups of patients are identified [10, 11].


i score more than seven - appendicitis confirmed

ii score of five and six – to be observed

iii score less than four- acute appendicitis is unlikely and

Correspondence: Gamini Abeyasinghe

E-mail: gbabey@slt.net.lk

 <https://orcid.org/0000-0001-9335-0015>

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other causes of abdominal pain to be conceded

The Alvarado score was developed in 1986 as a diagnostic tool [12, 13, 14]. Surgeons have found that this score is a sensitive diagnostic tool for the diagnosis of acute appendicitis, but many researchers have found that the Alvarado score has poor accuracy in Asian populations [13, 14]. The score is well calibrated in men but tends to be over predictive in females [14]. This was a study to assess the sensitivity and specificity of the current recommended ALVARADO score cutoff and to determine an appropriate cut off point of Alvarado score for predicting the diagnosis of Acute Appendicitis for Sri Lankan patients seeking health care at Matale General Hospital.

Materials and methods

This was a validation study conducted at General Hospital Matale Sri Lanka. The study population was all consecutive patients who were admitted with suspected acute appendicitis to the surgical units of the General Hospital Matale Sri Lanka for appendectomy. The study was carried out between the 1st of October 2016 to 31st of March 2017.

The target was 178 cases and controls [89 histologically confirmed cases of acute appendicitis and 89 histologically confirmed non-appendicitis controls] that had undergone appendectomy to detect a 90% sensitivity and a specificity, assuming 50% confirmed cases among the suspected, at a power of 80% [15]. All consecutive patients, meeting inclusion and exclusion criteria. Exclusion criteria were patients presenting with predominant urological and gynaecological symptoms and right iliac fossa mass. Data were collected by an interviewer-administered questionnaire and a data sheet by medical officers of the surgical unit. Data on socio-demographics of the patient and symptoms, signs and investigations about eight factors of Alvarado score were recorded. Relevant investigation results and post-operative histological findings were obtained from the bed head tickets. Alvarado score was calculated for each patient. The final diagnosis of "appendicitis" was based on histology [gold standard] for this study. Data were entered into SPSS version 16 which was used to analyze data. Clinical features and demographics were compared between the cases and controls and Cronbach's alpha was calculated to assess the internal consistency of the tool. The sensitivity and specificity of the Alvarado score were calculated. ROC curves were used to assess criterion validity where the "cases/controls" variable was the state variable, and the Alvarado score was the test variable. Coordinate points of the ROC were generated together with the curve. Written informed consent was obtained from the individuals before recruitment after explaining the purpose and the procedures of the study. For patients between 13 to 16 years, proxy consent was obtained.

Ethical clearance for the study was obtained from the Ethical Clearance Committee of the Faculty of Medicine, Peradeniya, Sri Lanka, a body which is recognized by the Forum of Ethical Clearance Committees of Asia and the Pacific.

The Alvarado score did not influence the management of the patient. The diagnosis of acute appendicitis was made on the decision of the Consultant Surgeon for management purposes. Confidentiality of data was ensured, and no individually identifiable data was exposed to a third party.

Results

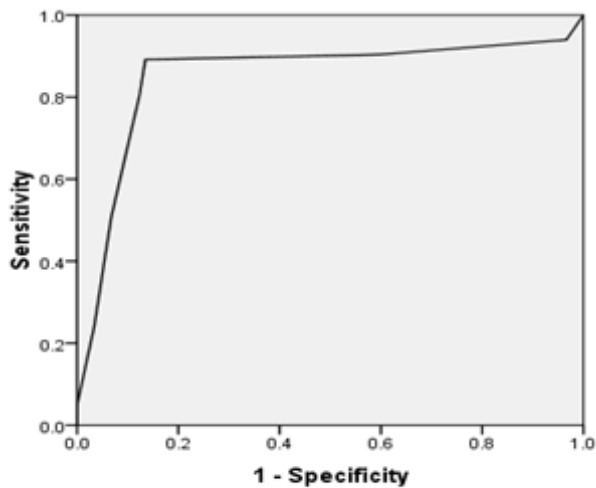
A total of 178 consecutive patients were recruited for the study. 6 were dropped due to incomplete data. Of the 172 participants with complete data who were included in the sensitivity and specificity analysis, 83 were histologically confirmed [cases] and 89 were negative for appendicitis [controls] [Table 2]. No statistically significant difference in the mean age or the sex composition between the cases and the controls were observed [Table 2]. A higher proportion of cases were found to be positive for all symptoms, signs, and laboratory investigations except fever. The Cronbach's alpha value was 0.63 and deleting items would not improve the value significantly [Table 5].

Sensitivity and specificity at a cut-off of 7: The cross-tabulation and the sensitivity and specificity calculation indicate that a cut-off of 7 provides a sensitivity of 62.5% and a specificity of 91% [Table 3]. Although the specificity is highly appropriate a sensitivity of 62.5% is not acceptable for a screening test. Apart from a low sensitivity the Negative Predictive Value [NPV] too was found to be low [72%].

Therefore, the sensitivity and the specificity of the test were calculated at different cutoff values of the Alvarado score [Table 4]. A cut off value of 4.5 provides a sensitivity of 89.2% and a specificity of 86.5%. This cutoff value increased the NPV to 89.5% [data are not shown] whereas the Positive Predictive Value was the same as for a cutoff of 7 which was an acceptable 86%. The ROC curve calculations indicated an area under the curve of 0.85 which was significant at the 95% confidence level [Figure 1].

Discussion

This study was conducted to evaluate the sensitivity and specificity of the Alvarado score in detecting acute appendicitis cases presenting to the surgical unit at a secondary care centre in central Sri Lanka. The tool returned a Cronbach's alpha value of 0.63 which is considered an acceptable level indicating the adequacy of internal consistency [16]. It was found that at a cut-off of 7 [9] as recommended by the developers of the tool, the sensitivity was unacceptably low at 62.7% but the specificity was high at



Diagonal segments are produced by ties.

Figure 1. ROC curve of Alvarado score
Area under the curve 0.85, P value <0.001

Table 1. Alvarado score calculation: symptoms, signs and laboratory investigations and the weights allocated to each if positive

Category	Symptom/sign/investigation	Score if positive
Symptom	Migrating pain	1
	Nausea/vomiting	1
	Anorexia	1
	Fever	1
Signs	RIF tenderness	2
	Rebound tenderness	1
Laboratory results	Leukocytosis	2
	Left shift	1
Total		10

*Alford Alvarado 1986 [9]

Table 2. Age, sex, symptoms, signs and laboratory investigations comparison between cases and controls

		*Total N [%]	Cases N [%] *Mean [SD]	Controls N [%] *Mean [SD]	P value
Age		176 [100]	*21.1 [13.1]	*22.2[10.9]	**0.53
Sex	Male	79 [100.0]	51 [64.6]	28 [35.4]	#0.488
	Female	86 [100.0]	51 [59.3]	35 [40.7]	
Migrating pain	Yes	28 [100.0]	27 [96.4]	01 [3.6]	#<0.001
	No	148 [100.0]	78 [52.7]	70 [47.3]	
Vomiting/nausea	Yes	112 [100.0]	68 [60.7]	44 [39.3]	#0.706
	No	64 [100.0]	37 [57.8]	27 [42.2]	
Fever	Yes	100 [100.0]	56 [56.0]	44 [44.0]	#0.319
	No	74 [100.0]	47 [63.5]	27 [36.5]	
Loss of appetite	Yes	104 [100.0]	78 [75.0]	26 [25.0]	#<0.001
	No	72 [100.0]	27 [37.5]	45 [62.5]	
RIF tenderness	Yes	172 [100.0]	105 [61.0]	67 [39.0]	*0.014
	No	4 [100.0]	0 [0.0]	4 [100.0]	
Rebound tenderness	Yes	63 [100.0]	62 [98.4]	1 [1.6]	#<0.001
	No	109 [100.0]	39 [35.8]	70 [64.2]	
WBC>10000	Yes	74 [100.0]	74 [100.0]	0 [0.0]	#<0.001
	No	101 [100.0]	30 [29.7]	71 [70.3]	
Neutrophilia	Yes	65 [100.0]	65 [100.0]	0 [0.0]	#<0.001
	No	109 [100.0]	38 [34.9]	71 [65.1]	
UFR	Yes	8 [100.0]	7 [87.5]	1 [12.5]	# [§] 0.001
	No	91 [100.0]	91 [100.0]	0 [0.0]	
CRP	Yes	47 [100.0]	46 [97.9]	1 [2.1]	# [§] 0.414
	No	31 [100.0]	31 [100.0]	0 [0.0]	

** students' t test

chi-square

WBC- white blood cell count

UFR- urine full report

CRP- c-reactive protein

\$ invalid due to more than 25% cells with expected count less than 5

Table 3. Appendicitis diagnosis based on the recommended cutoff value of Alvarado Score of 7 against the gold standard [Histological diagnosis]

		Histological diagnosis of Appendicitis		Total	Predictive values
		Yes	No		
Appendicitis Diagnosed based on Alvarado score > 7	Yes	52 [62.7%] *	8 [9%]	60 [100%]	^a PPV = 86%
	No	31 [37.3%]	81 [91.0%] **	112 [100%]	^b NPV= 72%
Total		83 [100%]	89 [100%]	172	

A cutoff of 7 provides a ^aSensitivity 62.7%, ^{**}specificity 91.0%, ^aPositive Predictive value 86% and ^bNegative Predictive Value 72%, for diagnosis of Appendicitis

Table 4. Sensitivity and 1-specificity of the Alvarado score at different Cut off values for screening of acute appendicitis

Cut off value	Sensitivity	1 - Specificity
1.0	100.0	100.0
2.5	94.0	96.6
3.5	90.4	59.6
4.5	89.2	13.5
5.5	80.7	12.4
6.5	62.7	09.0
7.5	50.6	06.7
8.5	24.1	03.4
9.5	04.8	00.0

A cutoff of 4.5 provides a Sensitivity 89.2%, specificity 86.5%, aPositive Predictive value 86% and bNegative Predictive Value 89.5 for diagnosis of Appendicitis

91.0%, for the patients evaluated. The PPV too was acceptable at 86.0%. In contrast, for Iraqi patients in Bagdad, the cutoff value of 7 provided a sensitivity of 89.6% and 92.3% with a positive predictive value was 98.7% and a negative predictive value of 57.4% in both males and females respectively [17]. One other study from the Asian region too reports high sensitivity and positive predictive values but low specificity at a cutoff of 7 [18]. Khan and Rehman have reported a Positive Predictive Value of 84% at a cutoff of 7 [19].

Although surgeons have found that this score is a sensitive screening tool for acute appendicitis [17–20] researchers have reported that the Alvarado score has poor accuracy [11–13,21]. The score was found to be well-calibrated in men but tended to be over predictive in females [13]. Some studies have shown that a cutoff of 7 does not suit all demographics and specific cutoff points may be required for males and females, adults and children, as well as for different ethnic

Table 5. Cronbach's alpha value of the Alvarado score and the item wise analysis of the value if item deleted

Total	value
Cronbach's alpha	0.64
Item	Cronbach's Alpha if Item Deleted
Migrating pain	.62
Vomiting/Nausea	.66
Fever	.69
Loss of appetite	.59
RIF tenderness	.66
Rebound tenderness	.56
WBC>10000	.46
Neutrophilia	.49

groups [7,13,20]. Some studies have indicated that a cutoff of 6 to be appropriate for all patients and both girls and boys under 16 years as well [20,22]. On the other hand, this finding reinforces the fact that the place of Alvarado score in the clinical management of acute appendicitis cases may not be clear [11]. The unsuitability of the Alvarado score for Bangladeshis has been demonstrated as well [23]. In the current study, a cutoff of 4.5 returned the best sensitivity and specificity [89.2 and 86.5 respectively]. This finding is closer to values that were mentioned in the systematic review by Ohle and others where cutoff values of 5 and 7 were evaluated and 5 was reported as acceptable [11]. An area under the curve of 0.85 of the ROC indicates a test that is acceptable as values above 0.7 are considered appropriate [17].

Conclusions

The Alvarado score is a reliable and valid CPR. A cutoff score of 4.5 is suggested as the best for the participants of this study. Since 4.5 is not a practically possible score due to the nature of it we suggest 5 as the cutoff for Sri Lankan patients. Multicenter studies would identify if the score can be generalized to Sri Lankans.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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An audit on open tibia fracture management at a tertiary level ortho-plastic center in Sri Lanka: are we following current guidelines?

Kuruwitaarachchi DKT^{1,2}, Mathangasinghe Y³, Munidasa D²

¹ Postgraduate Institute of Medicine, University of Colombo, Sri Lanka

² National Hospital of Sri Lanka

³ Department of Anatomy, Faculty of Medicine, University of Colombo, Sri Lanka

Keywords: Tibia; open fracture; orthopaedic; plastic surgery

Abstract

Introduction

Despite the availability of guidelines for the surgical management of open tibia fractures set out by developed countries, the adherence of the surgical teams to current recommendations is explored sparsely in resource-poor surgical settings. Here, we report current practice and ortho-plastic care gaps at managing open tibia fractures at the National Hospital of Sri Lanka [NHSL].

Methods

An audit was conducted on patients with open tibia fractures presenting to the NHSL. We explored if the ortho-plastic management practices adhere to the recommendations of the standard international guidelines.

Results

Thirty patients with compound fractures of the tibia were analyzed. The majority [n=12, 40%] had Gustilo-Anderson type 2 injuries. The median time of presentation from the injury was 2h [IQR=2.5h]. Only 50% of the patients received the first dose of antibiotics within three hours of injury. Initial wound debridement was conducted after a median time of 4.5h [IQR=2.2h] after admission. Only 16.6% of procedures liaised with the plastic surgical team. The median flap cover time was 10 [IQR=4] days. None of the patients underwent simultaneous internal fixation and soft tissue cover by orthopaedic interventions.

Conclusions

Timely antibiotic prophylaxis for open tibia fractures was achieved only in 50% of the patients due to late presentation. There were divergences from the current recommendations in the timing of soft tissue debridement and simultaneous ortho-plastic interventions, probably due to limited facilities, theatre time and relatively high patient load. We recommend strengthening ortho-plastic approaches and developing

national guidelines for open tibia fracture management which could help improve surgical outcomes.

Introduction


Open tibia fractures represent the commonest long bone fractures [1] with a reported global incidence ranging from 8.1 to 37.0 per 100 000 patients [2, 3]. Significant mortality and long-term morbidity are associated with open fractures of the tibia in patients with polytrauma [4], making surgical management challenging.

Several professional bodies in the developed countries have set forth guidelines for the management of open fractures of the tibia to optimize surgical management and improve postoperative outcomes. The British Orthopaedic Association [BOA] and the British Association of Plastic, Reconstructive and Aesthetic Surgeons [BAPRAS] published joint standards for the management of open fractures of the lower limb in 2009 [5, 6] which emphasized the importance of timely multidisciplinary management of open fractures to enable optimum recovery and minimize the risk of infection. In 2016 the national institute for health and care excellence [NICE] published 'newer NICE Complex Fractures: Assessment and Management guidelines', which aimed to minimize mortality and long-term morbidity by improving the quality of open fracture management at emergency units [7].

Despite widespread awareness of these guidelines and emphasis of their importance in orthopaedic and plastic surgery, the level of adherence to these protocols in developing countries is reported to be highly variable, mostly related to fracture stabilization, antibiotic prophylaxis and flap coverage [8]. The deviations from the recommended practice could be partly attributed to a lack of awareness among surgeons [8], hence regular audits to evaluate patterns of orthopaedic management in local settings are recommended. To our knowledge, there are no published audits on the management of open tibia fractures in Sri Lanka to date. Here, we report the results of an audit in a designated trauma centre in Sri Lanka with established orthopaedic and plastic surgical units, to provide insight into the current practice and ortho-plastic care gaps at managing open tibia fractures.

Correspondence: Kasun Kuruwitaarachchi

E-mail: kasunt2@gmail.com

 <https://orcid.org/0000-0002-9326-1407>

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Methods

This audit was conducted on patients with open fractures of the tibia admitted to accidents and orthopaedic service, National Hospital of Sri Lanka [NHSL] between 2019 July to 2020 July. Patients with multiple life-threatening injuries which affected the timing of open fracture management were excluded from the analysis. Details on patient demographics, type of injury, Gustilo-Anderson classification, initial assessment and treatments offered, the timing of initial debridement, involvement of the plastic surgical team, timing to soft tissue cover and antibiotic administration were obtained from medical notes and theatre records. Data from the initial survey were critically analysed against the published BOA/BAPRAS guidelines for the management of open fracture in view of identifying any deficiencies in management and possible areas of improvement.

Statistical analysis

Categorical data were presented as frequency and percentages while continuous data were reported as median and interquartile range unless otherwise specified. Mann Whitney U test was used to compare continuous data. Data analysis was conducted using SPSS version 27 at a significant level of 0.05.

Results

Thirty patients were analysed in this study. Of them, 19 were direct admissions to the NHSL while 11 were transferred from other hospitals. The male to female ratio was 10:3. The median age was 38 [IQR=30] years. All had compound fractures of the tibia and fibula. Additionally, one patella, one calcaneal and two closed femur fractures were present. The majority had right-sided fractures [n=21, 70%]. The frequencies of Gustilo-Anderson types 1, 2 and 3 injuries were 11 [37%], 12 [40%] and 7 [23%] respectively.

The visual inspections and normality tests of main variables showed that the data were not normally distributed [Supplementary Table 1]. The median time of presentation from the injury was 2h [IQR=2.5h]. This was significantly higher for those who were transferred [median=3h, IQR=2.5 h] as opposed to direct admissions to the NHSL [median=1h, IQR=1.3 h] [U=176.5, p=0.002]. The initial assessment was done by the attending registrar in 28 cases while the rest [n=2] were done by a medical officer. Initial photographs were taken in 8 [27%] patients on admission. Tetanus toxoid and intravenous cefuroxime were administered to everyone. Also, gentamycin was started on 9 patients. Fifty percent [n=15] of the patients received the first dose of antibiotic within three hours of injury while 11 [16.7%] received antibiotics within one hour of injury. Initial wound toilet with or without definitive surgery was conducted after a median time of 4.5h [IQR=2.2h] after admission, with a median duration of 7h

[IQR=4h] from injury to the initial treatment. The duration of injury to treatment was significantly higher in patients who were transferred from regional hospitals [median=7h, IQR=4.5 h] compared to direct admissions [median=6h, IQR=3.5 h] [U=160.5, p=0.014]. Nonetheless, there was no statistically significant difference in the duration between presentation and initial treatment of those who were admitted directly or transferred from regional hospitals [U=128.5, p=0.307]. However, all patients [100%] had initial surgical intervention done within the first 24 hours of injury. During the initial debridement external fixation, internal fixation and plaster of Paris [POP] cast application was performed in 13, 8 and 9 patients, respectively. None of the patients underwent simultaneous internal fixation and soft tissue cover by ortho-plastic interventions. The median time of definitive surgery after the initial injury for flaps was 10 [IQR=4] days. The median duration for exchange external fixation or POP to reamed tibia nails was 8.5 [IQR=4] days. Overall, ortho-plastic interventions were done in 5 [16.67%] patients. Seven patients were decided to be managed conservatively.

The median duration of hospital stay of the patients who underwent definitive surgery or plastic interventions [n=23] during initial admission was 16 [IQR=5] days.

Discussion

Sri Lankan primary healthcare system has been internationally recognized as a leading and highly cost-effective model among the developing countries [9]. Nonetheless, the state sector faces substantial difficulties in providing specialized healthcare facilities due to the lack of resources and heavy patient load. This audit reports current practices in the management of open tibia fractures in the National Hospital of Sri Lanka with an emphasis on potential avenues to improve ortho-plastic healthcare delivery.

Compared to developed countries, we report a considerable delay in the presentation of the patients after compound fracture of the tibia in Sri Lanka [median=2h, IQR=2.5h]. Therefore, only 50% of patients received prophylactic antibiotics within 3 hours of injury. Although there was a significant delay in the presentation of transferred patients compared to direct admissions, all received the initial dose of prophylactic antibiotics before the transfer. Antibiotic prophylaxis is considered the single most important intervention to prevent secondary infections at the injury site, thus guidelines recommend administering broad-spectrum antibiotics as soon as possible following the injury, at least within 3 h [6]. Current recommendations are to use either intravenous co-amoxiclav 1.2g 8-hourly or a cephalosporin such as cefuroxime 1.5g 8-hourly as prophylaxis, gentamicin 1.5 mg/kg at the time of debridement and gentamicin 1.5 mg/kg and either vancomycin 1 g or teicoplanin 800 mg on

induction of anaesthesia at the time of skeletal stabilization with or without soft tissue cover. [6] In line with these standards, all patients in our study sample received cefuroxime prophylaxis. Also, some patients who had highly contaminated wounds received a single dose of gentamycin during the initial assessment. Rupp et al. advocated the use of additional gram-negative antibiotic coverage for Gustilo-Anderson type III fractures and high dose penicillin prophylaxis if faecal or clostridia contamination is suspected [10]. However, prophylaxis with piperacillin/tazobactam showed no inferior results compared to the combined use of cephalosporin and gentamicin for Gustilo-Anderson type III open fractures with regard to surgical site infections after 30 days, fracture non-union, re-hospitalization rates or deaths at one year [11].

The majority of the patients underwent initial debridement within 12 hours irrespective of the mechanism of injury or time of the admission to the hospital. Guidelines advocate to practice early but proper and extensive initial debridement in an elective trauma list once experienced orthopaedic and plastic surgeons are available, because of avoiding repeated debridement as it found to increase risk of infections [12]. We found that the majority of the initial wound debridement was performed by a speciality training orthopaedic registrar or a medical officer while only 16.6% of procedures liaised with the plastic surgical team. This practice is suboptimal as current guidelines encourage performing initial debridement with the involvement of both orthopaedic and plastic surgeons [6]. This, most likely, could have been a result of heavy patient burden and limited theatre time which is universally observed in developing countries. Nonetheless, this practice is consistent with the findings of other similar research conducted in the developed countries [13, 14].

The optimal timing of soft tissue cover has been debated over the last few decades [15, 16]. Performing flap cover for open tibia fractures early as possible, at least within 7 days, may help minimize complications [17]. In contrast, we report an average flap cover time of 12.5 days after the injury. None of the patients underwent simultaneous internal fixation and soft tissue cover by ortho-plastic intervention, instead, internal fixation was planned after achieving a desirable soft tissue status. This too is a divergence from current recommendations for performing definitive fracture stabilization with soft tissue cover at the same time as it is associated with significantly low rates of infections [6].

This audit has certain limitations owing to the small sample size and since it was based on a single centre. We recommend regular audits to capture the current practices in orthopaedic care delivery in multiple stations. Developing national guidelines, considering the facilities available, could

circumvent the difficulties in strictly adhering to the guidelines set out by developed countries, which has been successful in improving orthopaedic care in many low and middle-income countries [18]. Moreover, attention should be paid to improve ortho-plastic approaches for limb reconstruction which could improve surgical outcomes of patients with open tibia fractures in Sri Lanka [6].

Conclusion

Timely antibiotic prophylaxis for open tibia fractures was achieved only in 50% of the patients. There were divergences from the current recommendations in the timing of soft tissue debridement and simultaneous ortho-plastic interventions, probably due to limited facilities, theatre time and relatively high patient load. We recommend strengthening ortho-plastic approaches and developing national guidelines for open tibia fracture management which could help improve surgical outcomes.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Outcome of partial cystectomy for non-urothelial urinary bladder malignancies in a tertiary care urology unit in Sri Lanka

Umesh Jayarajah, Kasun Herath, Manoj Hilary Fernando, Serozsha Goonewardena
Department of Urology, National Hospital of Sri Lanka, Colombo, Sri Lanka

Keywords: Partial cystectomy; non-urothelial urinary bladder malignancies; outcomes

Abstract

Introduction

Non-urothelial bladder cancers (NUBC) are very aggressive form of tumors and the standard treatment is radical cystectomy which is associated with high morbidity. This study was aimed to describe the outcome of partial cystectomy for selected patients with NUBC in a tertiary care urology unit in Sri Lanka.

Methods

A retrospective analysis of all patients (n=7, males=4) who underwent partial cystectomy for NUBC in a tertiary care urology unit in National Hospital of Sri Lanka over a period of 16 years was done (From 2001 to 2016). All underwent preliminary transurethral resection of bladder tumour (TURBT), histological confirmation and imaging before partial cystectomy. Lymphadenectomy was performed in patients with macroscopic involvement.

Results

The median age was 59 years (range:40-71). Six patients had haematuria at presentation. Four patients had primary adenocarcinoma of the bladder. Others were leiomyosarcoma, small cell cancer and goblet cell carcinoid tumour. The majority had muscle invasive disease as confirmed by histopathology. The patients with signet ring cell carcinoma, leiomyosarcoma and well differentiated adenocarcinoma had favorable outcomes, while patients with papillary carcinoma, small cell carcinoma and goblet cell carcinoid tumour showed poor outcomes.

Conclusion

Partial cystectomy was associated with variable outcomes. Further analyses are necessary to understand the factors

associated with favorable outcomes which would be helpful in patient selection.

Introduction

Non-urothelial bladder cancers [NUBC] are a rare and generally aggressive form of tumours accounting for less than 5% of all bladder tumours [1, 2]. Due to the rarity, the understanding of tumour behaviour and effective management strategies are poor. At present, the accepted surgical treatment is radical cystectomy which is associated with high morbidity and poor quality of life [1, 2]. Furthermore, this may be unsuitable for elderly patients with significant comorbidities. Some patients refuse to undergo the surgery in our setting due to the associated functional morbidity. Therefore, such patients with NUBC with potentially resectable tumours were offered partial cystectomy. We report the outcome of partial cystectomy for selected patients with NUBC in a tertiary care urology unit in Sri Lanka.

Methods


Seven patients including 4 males and 3 females, who underwent partial cystectomy for non-urothelial bladder cancers in a tertiary care urology unit in National Hospital of Sri Lanka over a period of 16 years (From 2001 to 2016) were described. All patients underwent transurethral resection of the bladder tumour (TURBT) which was the standard procedure in the initial diagnosis and treatment of bladder cancer. Furthermore, histological confirmation and ultrasonography/ contrast enhanced computed tomography (CT) imaging was performed before partial cystectomy. Lymphadenectomy was performed in patients with macroscopic involvement. Details of patients were collected from hospital and clinic records. Ethical approval was obtained from the Ethics Review Committee of the National Hospital of Sri Lanka.

Results

Table 1 gives the summary of the 7 cases. The median age was 59 years [range: 34-71]. Six patients had haematuria at presentation. The majority of tumours were seen in the anterior wall and dome of the bladder. Four patients had primary adenocarcinoma of the bladder, of which one patient

Correspondence: Umesh Jayarajah

E-mail: umeshe.jaya@gmail.com

 <https://orcid.org/0000-0002-0398-5197>

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Table 1. Clinicopathological characteristics and outcome of patients who underwent partial cystectomy for non-urothelial bladder cancer

Age	Sex	Presentation	Imaging	Procedure	Lymphadenectomy	Histology	Immunohistochemistry	Outcome	Period without recurrence	Period without progression	Overall survival
71	F	Painless haematuria for 2 months	USS: 2.1 x 1.5 x 1.5 cm Anterior bladder wall growth	Partial cystectomy	Not done	pT2 Signet ring type primary Adenocarcinoma of the bladder. No lymphovascular or perineural invasion.	Cytoplasm positive for CK20 and CK07 Nuclear positivity for CDX2 Membrane positivity for beta-catenin	Alive at 20 months with no recurrence	>18 months	>18 months	>24 months
64	F	Lower abdominal pain for 3 months	CECT: 7.9x6.9x6.3 cm mass anterior bladder wall	Partial cystectomy	Not done	pT3b Moderately differentiated adenocarcinoma No Lymphovascular invasion. Tumour necrosis present.	Not done	No CT evidence of recurrence at 4 months and asymptomatic at 9 months	4 months	4 months	9 months and there after lost to follow up
40	M	Painless haematuria for 1 month	USS: 3.7 x 2.8 x 3.9 cm Dome and anterior wall mass	Partial cystectomy followed by chemotherapy	Not done	pT1 Primary papillary adenocarcinoma No lymphovascular and perineural invasion.	Cytoplasm positive for CK20, CK7, CD10 and PSA: negative	Died after 6 months following surgery	Not known	Not known	6 months
59	M	Haematuria for more than 1 year	CECT: 2 x 2.3 x 2.1 cm nodule in anterior bladder wall	Partial cystectomy	Not done	pT2b Well differentiated adenocarcinoma. No lymphovascular and perineural invasion	Not done	Alive at 28 months follow up without recurrence	>28 months	> 28 months	>28 months
54	F	Painless haematuria for 2 months	USS: 2.7 x 2.5 x 2.3 cm Anterior bladder wall growth	Partial cystectomy	Not done	pT4 Moderately differentiated leiomyosarcoma invading the rectus abdominis muscle	Positive for smooth muscle actin and desmin. Negative for CD117. The Ki67: 70–80%.	Alive with no evidence of recurrence at 3.5 years	>42 months	>42 months	>42 months
60	M	Haematuria with clots for 11 months	USS: 3.5 x 3 x 2.5 cm Dome and anterior wall mass lesion	Partial cystectomy	Not done	pT2 small cell carcinoma with squamous differentiation	Not done	Died at 6 months	3 months	3 months	6 months
34	M	haematuria with clots for 5 months	USS: 6 x 6 x 3 cm right posterior wall mass	Partial cystectomy +limited pelvic lymphadenectomy +sigmoid colostomy followed by chemotherapy	Macroscopically enlarged nodes were removed	pT4 Goblet cell carcinoid tumour of the bladder. Pelvic lymph nodes positive for tumour	Chromogranin A: Occasional positive cells, PGP 9.5 Several positive cells, NSE negative	Died at 9 months	3 months	-	9 months

had signet ring cell adenocarcinoma. Others had leiomyosarcoma, small cell cancer with squamous differentiation and goblet cell carcinoid tumour of the bladder. The majority [n=6] had muscle-invasive disease at surgery as confirmed by histopathology. The patients with signet ring cell carcinoma, leiomyosarcoma and well-differentiated adenocarcinoma had favourable outcomes [Table: 1], while patients with papillary carcinoma, small cell carcinoma and goblet cell carcinoid tumour showed poor outcomes. One patient with pT3b moderately differentiated adenocarcinoma had no CT evidence of recurrence at 4 months and was asymptomatic at nine months but thereafter, she was lost to follow up.

Discussion

Partial cystectomy is considered for selected urothelial carcinoma due to its function preservation and lesser surgical morbidity [3]. Recently, more cases of young patients with NUBC have been treated with partial cystectomy. However, they are restricted to a few case reports and series [4]. We reported our experience on partial cystectomy for NUBC which showed variable outcomes.

In our series, 4 patients had adenocarcinoma of the bladder. The adenocarcinoma of the bladder accounts for 0.5-2% of bladder cancers with the majority having a muscle-invasive disease. These are generally treated with radical cystectomy and pelvic lymph node dissection [5]. The 5-year overall survival rates are 10% to 60% for bladder adenocarcinomas. Of the different histological variants of adenocarcinoma, signet ring cell carcinoma is considered to have the worst outcomes [5]. In our series, 2 patients had a good outcome with no recurrence and of which, one patient had signet-ring cell carcinoma which is known to be associated with the worst prognosis. One patient was lost to follow up but the computed tomography [CT] at 4 months post-op did not show any recurrences. Papillary adenocarcinoma had the worst prognosis with overall survival of only 6 months.

Sarcomas are the commonest mesenchymal cancers of the bladder and leiomyosarcoma is the commonest histology variant. Although initial evidence suggested aggressive tumour biology, a recent larger case series of 35 patients, showed relatively favourable outcomes [recurrence rate-34%, 5-year disease-specific survival-62%] [6]. In our series, one patient had leiomyosarcoma of the bladder and had an excellent outcome with no detectable recurrence at 5 years.

Neuroendocrine carcinoma of the urinary bladder is very rare, accounting for only 0.35- 0.70% of all bladder cancers and is further subdivided into small cell and large cell carcinoma [7]. To date, there is no standard treatment for the disease because of a lack of data due to the rarity of the disease. In a multi-

institutional review of 64 patients in the United States 5-year disease-specific survival rates among patients who underwent radical cystectomy was only 16%. Furthermore, the place for cystectomy is doubtful as there is no difference in survival between patients who underwent cystectomy and patients without surgery [7]. Our patient with muscle-invasive small cell carcinoma had a poor outcome with overall survival of only 6 months. Another patient with a goblet cell carcinoid tumour of the bladder also had a poor outcome.

There are no large scale prospective studies analyzing the effectiveness of partial cystectomy for NUBC and current evidence is only restricted to few case reports and case series. We reported our experience which showed variable outcomes following partial cystectomy for NUBC. In our series, some tumours which are believed to have a worse prognosis such as signet ring cell carcinoma and leiomyosarcoma had good outcomes following partial cystectomy. Radical cystectomy is associated with high morbidity due to surgery and poor quality of life and may not be suitable for patients with significant comorbidities. In future, with advances in early detection and accurate staging, partial cystectomy may be offered for selected patients with early NUBC. However, further studies will be required to study the role of partial cystectomy for NUBC in terms of factors associated with outcome and patient selection.

Conclusion

In this series of NUBC, partial cystectomy was associated with variable outcomes. Careful patient selection with specific emphasis on the tumour type, location and staging with prior patient counselling is mandatory. Further analyses are necessary to understand the factors associated with good outcomes following partial cystectomy which would be helpful in patient selection.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Study on the variations of the ventral abdominal aortic branches : a computed tomography based study

Joel Arudchelvam
Teaching Hospital Anuradhapura, Sri Lanka

Keywords: Aortic branching; Sri Lankan population; coelio mesenteric trunk; coeliac axis variations

Abstract

Introduction

The abdominal aorta [AA] begins at the aortic hiatus [at the 12th thoracic vertebra [T12]] and ends at the fourth lumbar vertebra [L4]. The main ventral branches of the AA are Coeliac Axis [CA], Superior Mesenteric Artery [SMA] and Inferior Mesenteric Artery [IMA]. Variations occur in branching pattern and the level of origin.

Methods

This is a cross-sectional, descriptive Computed Tomographic imaging [CT] based study done at the Teaching Hospital Anuradhapura, Sri Lanka from November 2018 to March 2019. Consecutive patients undergoing CT abdomen at the radiology department were selected. All images were analysed by the author in conjunction with the radiologist. Images of patients less than 25 years, incomplete records, non-clear images and images with the non-identifiable origin of the arteries were also excluded.

Results

102 were included. 53.9% were males. The mean age was 58.0 years. CA originated at the level of T12 in 68.3%. SMA originated at the L1 level in 90.2%. IMA originated at the L3 level in 89.3%. AA divided at the level of L4 in 81.8%. Three [2.9%] had variations including coelio mesenteric trunk, splenic artery/left gastric artery directly arising from the aorta.

Discussion and Conclusions

Visceral branches of AA develop from omphalo-mesenteric arteries [vitelline arteries] and their ventral anastomosis. The regression pattern of these arteries results in variations. In this study, SMA had the most consistent level of origin at L1. Variations of CA and SMA occurred in 2.9%. Awareness of these is important to avoid complications, especially in

emergency surgeries.

Introduction


The abdominal aorta [AA] begins at the level of the twelfth thoracic vertebra [T12] at the aortic hiatus of the diaphragm and ends by dividing into common iliac arteries [CIA] at the level of the fourth lumbar vertebra [L4]. The main anterior visceral branches of the AA are coeliac axis [CA], superior mesenteric artery [SMA] and inferior mesenteric artery [IMA]. Generally, CA originates at the level of T12, SMA arises at the level of L1 approximately 1.5 cms below the CA and the IMA originates at the level of L3. CA divides into common hepatic artery [CHA], splenic artery [SA] and left gastric artery [LGA]. These branches supply the liver, stomach, duodenum, pancreas and spleen. The absence of LGA results in the hepatosplenic trunk [HST] and the absence of SA results in the hepato gastric trunk [HST]. SMA supplies the entire small intestine other than the first part of the duodenum and it also supplies part of the large intestine [up to the left 1/3 of the transverse colon]. IMA supplies left [distal] 1/3 of the transverse colon, descending colon and the upper part of the rectum.

Variations of the level of origin and branching patterns of these arteries are known to occur due to the changes which take place during embryonic development [1]. The reported incidence of variations of the CA and the SMA are between 3% to 7.2% [2] [3]. Awareness of these variations is important to avoid disasters during interventions and surgeries. Such an instance is the absence of a superior mesenteric artery which is associated with dilatation of the inferior mesenteric artery. In such a situation ligation of the IMA, when repairing abdominal aortic aneurysm, results in lower intestinal ischaemia. Awareness of variations in CA and SMA is also important in liver transplantation [also in organ retrieval], liver resection, surgeries of the stomach and chemomobilization of liver tumours. Also, awareness of these variations in anatomy will prevent unnecessary dissection and associated morbidity during surgery and will prevent prolongation of surgeries.

This study aimed to describe the prevalence of variations of the level of origin and branching pattern of the anterior visceral branches of the aorta among patients presenting to the

Correspondence: Joel Arudchelvam

E-mail: joelaru@yahoo.com

 <https://orcid.org/0000-0002-4371-4527>

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Methods

This was a cross-sectional descriptive study. Consecutive patients undergoing CT abdomen at the radiology department were selected. The study was done at the THA, Sri Lanka, from November 2018 to March 2019. Contrast-enhanced computed tomographic angiography [CTA] images in an arterial phase were analysed. All CT scans were performed by 160 detectors Toshiba Aquilion scanner machine. All images were transferred to the console and 3D reconstructions were made before analysis. The CTA images were analysed by both the author and the radiologist in the CT scan working station [console room]. Data on the patient's age, gender, details on branching level [Vertebral level] variations, branching pattern variations and the vertebral level of aortic division were obtained. Patients younger than 25 years were excluded. Because the vertebral level of origin is known to vary with the growth of the individuals [4]. Besides incomplete records, non-clear images and images with the non-identifiable origin of the arteries were also excluded from the analysis.

Results

A series of images from 102 patients were included. There were 55 [53.9%] males and 47 females. The mean age was 58.0 years [30 -88]. CA originated at the level of T12 in 68.3% and L1 level in 31.7% of patients. In females, CA was arising at T12 in 66.0% of individuals whereas it was arising at T12 in 70.4% of males. But this difference was not statistically significant [P-0.30]. SMA originated at the L1 level in 92 [90.2%] and T12 level in 9 [8.8%]. Of the 9 patients on whom the SMA originated at T12, 6 [66.7%] were females.

This difference was not statistically significant [p-0.20]. IMA originated at the L3 level in 89.3% and L2 level in 8.9%. IMA was not visualised in 29.1%. This happened in elderly patients

due to atherosclerotic occlusion of the Ostia of the IMA. AA divided at the level of L4 in 81.8% and L3 in 18.2%. These differences of the level of origin were not significantly different between males and females. Three [2.9%] had variations, those were;

Coeliomesenteric trunk [CMT] in one patient [0.98%] [Figure 2]– In this variation, the CA and the SMA have a common origin.

Splenic artery [SA] arising directly from the aorta [this is also called the Hepato Gastric Trunk - HGT] – This was found in one [0.98%]. Left gastric artery [LG] arising directly from the aorta [in this situation the CHA and splenic arteries have a common origin i.e. hepatosplenic trunk - HST] – found in one [0.98%].

Discussion and conclusions

CA and SMA develop by a series of ventral branches [omphalomesenteric arteries -OMA or vitelline or ventral splanchnic arteries] from the dorsal aorta which appears during the embryological period [Figure 1]. These branches supply the yolk sac in the embryo [5]. A ventral longitudinal vessel connects the OMA [ventral longitudinal anastomosis] [1]. The first OMA develops into CA while the fourth develops into SMA. The common hepatic artery [CHA], LG and SA develop from this longitudinal anastomosis. The part of the longitudinal anastomosis distal to these branches and the second, third OMA disappear thus separating CA and SMA. If the First or the fourth OMA disappear common coelio mesenteric trunk develops. Other forms of regression of anastomosis and regression of OMA result in other variations.

The reported incidence of CMT is about 2.7% to 5.4% [1]. While the reported incidence of HGT is between 0.08% to

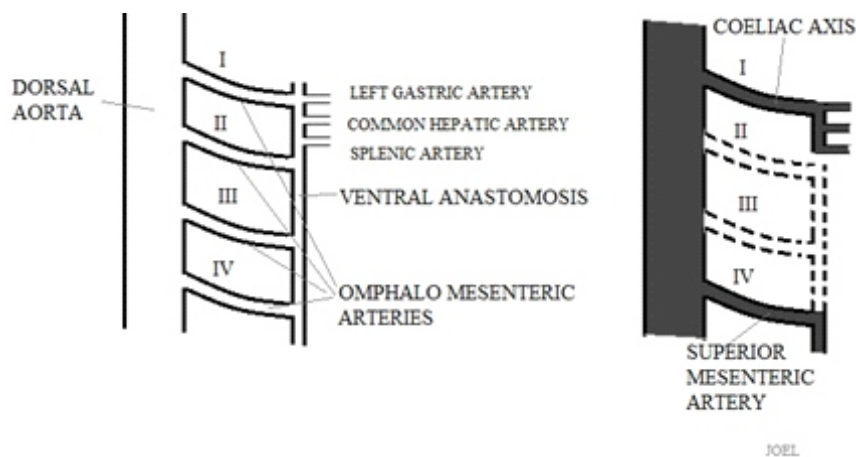


Figure 1. Coelio Mesenteric Trunk development



Figure 2. Coelio mesenteric trunk

7.2% [2] [6]. HST occurs at a rate of 0.02% [7]. In this series, CA originated at the level of T12 in 68.3% of individuals. Other similar series also report a similar level of origin in about 38% - 64% of cases [5] [8]. The SMA is fairly constant in respect to the level of origin i.e. 90.2% at the L1 level. The reported level of origin of IMA is at L3 in 47 - 66% of cases [9]. Knowing the level of origin of the CA and its branches variation is extremely important especially in upper abdominal and liver surgeries. Accidental ligation of variant arteries e.g in the case of Celio mesenteric trunk can result in disastrous complications [10]. Similarly in the case of bleeding pre-operative knowledge of the variations is important to prevent unnecessary complications. Besides in endovascular aneurysm repair, knowing the exact level of origin and the variations is important to prevent inadvertent occlusion of the origin and post-procedure organ ischemia. Another example is the absence of a superior mesenteric artery which is associated with dilatation of the inferior mesenteric artery. In such a situation ligation of the IMA, when repairing abdominal aortic aneurysm, results in lower intestinal ischaemia [11].

Division of aorta occurs above the level of L4 vertebral level in 18.2% [as in this series] to as high as 53.84% in some series [10]. Knowing this level is also important in clinical practice. When radiotherapy is utilised to treat carcinoma of the cervix, usually the upper limit is determined as L4-L5 intervertebral disc. This level is chosen to cover the iliac lymph nodes. If there is a higher division of the aorta [i.e. at L3 level in 18.2% as in this series], a significant length of CIA and therefore a significant number of iliac lymph nodes would be missed if the radiotherapy field is not shifted upwards. Therefore knowing the level of aortic division is important.

Therefore as discussed above branching variations occur in the anterior visceral branches of the abdominal aorta especially about the level of origin and the branching pattern especially in CA and its branches [2.9%] as in this series. The awareness of these variations in the branches of the aorta is important especially during emergency surgeries. The practice of pre interventional imaging and determination of the variations is important to prevent unwanted complications.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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A prospective study of a cohort of patients with necrotizing fasciitis at a level 2 hospital in Sri Lanka

Janaka Perera, Piyal Kurukulasooriya
Surgical Department, District General Hospital Polonnaruwa

Keywords: Necrotizing fasciitis; atypical presentations

Abstract

Necrotizing fasciitis is a rapidly progressive inflammation and necrosis of soft tissues and fascia, accompanied by severe systemic toxicity. In some cases early diagnosis is challenging. Objective of this study is to identify basic investigations that will aid in early diagnosis in such equivocal cases.

This is a prospective study. Patients who underwent wound debridement for clinically diagnosed necrotizing fasciitis and suspected necrotizing fasciitis at a level 2 hospital in Sri Lanka were included in the study. All together there were 24 patients who were diagnosed to have necrotizing fasciitis with intraoperative findings. In all patients we did full blood count [FBC], C-reactive protein [CRP], random blood sugar [RBS], Arterial blood gas analysis [ABG], plain x-ray films of affected area and wound swab culture and ABST before surgical intervention. Mean age was 67.2 [range: 38-85] years. Diabetes mellitus was a co-morbidity in 67% of patients. Commonest affected area was the lower limbs. Out of all patients 62% of patients had a history of muddy water contact. All the patients had WBC more than 15,000 where as 58% of patients had WBC more than 25,000. CRP was more than 150 in 83% patients. Among all 54% of patients' plain x-rays were positive for soft tissue gas. Majority of wound swab cultures were poly microbial. Commonest organisms were Streptococcus species, Staphylococcus and enterobacteriaceae.

Overall death rate was 42% in this study. Among 14 patients who were diagnosed on admission, 3 patients died. Death rate was 21%. Among 10 patients whose diagnoses got delayed, 7 patients died. Death rate was 70%.

A high clinical suspicion of necrotizing fasciitis is needed in an elderly patient presenting with cutaneous infection causing swelling, pain and erythema, with co-morbidity of diabetes.

High WBC, High CRP and presence of soft tissue gas in plain x-rays are highly suggestive for underline necrotizing fasciitis. Diagnostic score for Necrotising fasciitis can be made using these basic investigations and x-ray findings which need to be validated in further studies.

Introduction

Necrotizing fasciitis is a rapidly progressive inflammation and necrosis of fascia, underlying muscle, subcutaneous fat and overlying skin which is often accompanied by severe systemic toxicity[1]. Infection typically starts and spreads along the muscle fascia due to its relatively poor blood supply; muscle tissue is frequently spared because of its generous blood supply. Initially, the overlying tissue can appear unaffected; therefore, necrotizing fasciitis is difficult to diagnose without direct visualization of the fascia. It is first described by Hippocrates in the fifth century B.C. Although the incidences of necrotizing fasciitis are ranging between 0.3 to 15 per 100,000 population all over the world, mortality rates are very high. Irrespective of the advances of care case fatality rate is approximately 30% and over many years it has remained almost unchanged[1].


Necrotizing infection most commonly involves the extremities [lower extremity more commonly than upper extremity][2]. Other presentations are necrotizing fasciitis of the perineum [Fournier's gangrene], head and neck region. Usually there is preceding event like major penetrating trauma, minor laceration or recent surgery.

Necrotizing infection usually presents acutely [over hours]; rarely, it may present sub acutely [over days]. Rapid progression can occur, leading to systemic toxicity, limb loss, and death.[1] Common clinical manifestations include erythema, oedema, severe pain, fever, crepitus, skin bullae, necrosis, or ecchymosis. Conditions which can presents in the same way are cellulitis, deep vein thrombosis etc.

Laboratory findings are generally nonspecific. Abnormalities may include leucocytosis, acidosis, coagulopathy, hyponatremia, elevated inflammatory markers [C-reactive protein and/or erythrocyte sedimentation rate], and elevations in serum creatinine, lactate, creatine kinase [CK], and aspartate aminotransferase [AST][1]. Risk Indicator for

Correspondence: Janaka Perera

E-mail: asankajanaka@ymail.com

 <https://orcid.org/0000-0002-0764-9959>

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Necrotizing Fasciitis [LRINEC] score has been described; it is based on laboratory indicators including white cell count, haemoglobin, sodium, glucose, creatinine, and C-reactive protein. The tool was initially noted to have high specificity and negative predictive value; however, subsequent studies have demonstrated limited sensitivity[3].

Although classically a clinical diagnosis, imaging is a powerful adjunct to facilitate early diagnosis in equivocal cases. The findings of dissecting gas along fascial planes in the absence of trauma in plain x-rays is a specific sign, but is only seen in 24.8–55.0% of patients[2]. Compared to plain radiography, CT provides higher sensitivity [80%]. But compared to CT, plain x-rays are freely available and easily accessible in level 2 hospitals here.

The diagnosis of necrotizing infection is established via surgical exploration of the soft tissues in the operating room[1]. Intraoperative specimens should be sent for Gram stain and culture. Multiple bacteria are often involved. Based on the etiology it is divided into two main types which are polymicrobial and monomicrobial. In polymicrobial type anaerobic species [most commonly *Bacteroides*, *Clostridium*, or *Peptostreptococcus*] is isolated in combination with *Enterobacteriaceae* [*Escherichia coli*, *Enterobacter*, *Klebsiella*, *Proteus* etc] and one or more facultative anaerobic streptococci [other than group A *Streptococcus* [GAS]]. In monomicrobial type necrotizing infection is usually caused by GAS or other beta-hemolytic streptococci[1].

Diabetes, Immunosuppression, advanced age, Chronic systemic diseases [renal failure, atherosclerosis, and hypertension] are considered as predisposing factors[5].

Necrotizing fasciitis is a surgical emergency. The degree of suspicion should be high since the clinical presentation is variable and prompt intervention is critical. The lay press has referred to organisms that cause NSTI as "flesh-eating bacteria"[1]. Treatment includes early diagnosis, prompt surgical debridement and parenteral antibiotics[6].

In some atypical cases early diagnosis is challenging and result a delay in diagnosis and treatment. Basic laboratory investigations [FBC, CRP, RBS, and Serum Lactate] might helpful in diagnosis of atypical presentations. Although not routinely performed presence of soft tissue gas and inflammatory changes in plain x-ray might help in early diagnosis of such atypical presentations in resource limited settings. To correlate the possibilities if there are any, between those freely available and cost effective investigations which are available even in a resource poor setting towards early diagnosis of necrotizing fasciitis is the purpose of this study.

Objectives

Objectives of this study are to correlate basic laboratory investigations, importance of positive plain x-ray findings to formulate a combined diagnostic score with basic laboratory tests and plain x-rays towards early diagnosis of atypical presentations and to identify common causative organisms for necrotizing fasciitis.

Methodology

This was a prospective study. Patients who underwent wound debridement for clinically diagnosed necrotizing fasciitis in the extremities and suspected necrotizing fasciitis in the extremities at a level 2 hospital in Sri Lanka from August 2019 to March 2020 were included in the study. In all patients we did full blood count [FBC], C-reactive protein [CRP], random blood sugar [RBS], arterial blood gas analysis [ABG], plain x-ray films of affected area and wound swab culture and ABST before surgical intervention. Laboratory data, x-ray findings, comorbidities and outcomes were collected for each patient and extracted for analysis.

Results

A total of 26 patients who were clinically diagnosed to have necrotizing fasciitis underwent surgical intervention. Out of that 24 patients were diagnosed to have necrotizing fasciitis by intraoperative findings of soft tissue necrosis and infection. Only those with confirmed intraoperative diagnosis were included in the study. Among those diagnosed patients 14 patients were diagnosed on admission by clinical presentation while rests of 10 patients' diagnoses were delayed until septic features were developed because of their atypical initial presentations.

There was no delay in treatments for clinically apparent necrotizing fasciitis whose first surgical debridement were done in the same day in few hours of admission. Delay in offering initial debridement for certain cases were only because delay in diagnosis due to atypical presentations. Subsequent wound debridements were done without any delay depending on patients' clinical condition and wound status.

Out of them 17 were males and 7 were females. Mean age was 67.2 [range: 38–85] years. Diabetes mellitus was a co-morbidity in 67% of patients. Commonest affected site was the lower limbs which was 21 out of 24. Other 3 patients had disease involvement in their upper limbs. Among those 21 patients 15 patients had minor skin breach. None of patients had major blunt or penetrating trauma or any surgical procedures in that affected limb in the recent past. Among those 21 patients 62% had history of muddy water contact.



Figure 1. AP view of right foot showing soft tissue gas [indicated by arrow]

All the patients had WBC more than 15,000 where as 58% of patients had WBC more than 25,000. CRP was more than 150 in 83% patients.

Among 14 patients who were clinically diagnosed to have necrotizing fasciitis on admission 7 patients had soft tissue gas in their plain x-rays. Among patients whose diagnosis got delayed 6 out of 10 patients had soft tissue gas in their plain x-ray films. Among all, 54% of patients' plain x-ray films were positive for soft tissue gas [Figure 1].

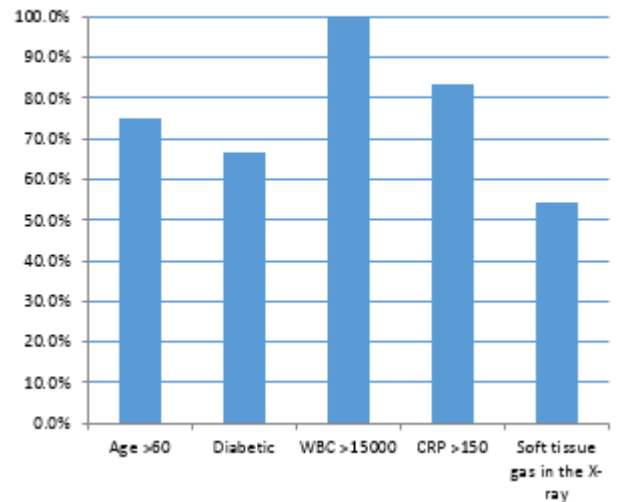
Mortality in our study was 42% [n=10]. Among 14 patients who were diagnosed on admission, 3 patients died. Among 10 patients whose diagnoses got delayed, 7 patients died.

Majority of wound swab cultures were poly microbial. Commonest organisms identified were Streptococcus species, Staphylococcus aureus, Enterobacteriaceae, Pseudomonas aeruginosa and Clostridium species.

Discussion

Necrotizing fasciitis is a rare but very destructive invasive infection of skin, subcutaneous tissues and deep fascia[1]. It is often polymicrobial[7]. Diabetes, Immunosuppression, advanced age, Chronic systemic diseases [renal failure, atherosclerosis, and hypertension] are considered as predisposing factors[1]. Early diagnosis is lifesaving in managing necrotizing fasciitis patients. Treatment includes prompt surgical debridement, parenteral antibiotics and nutritional support.

Results of our study



It appears from the data in this study, the disease is commoner in males than females with the mean age 67.2 years. Similar studies also reported that the majority of patients were male and the mean age was between 50 to 60 years in those studies[8]. In this study most commonly affected site was the lower extremities probably due to most of patients in this agricultural area were farmers with a history of muddy water contact. A systemic review of similar studies which has done previously also shows lower extremity is commoner than the upper extremity in regard necrotizing fasciitis[2].

Out of 24 patients 14 patients had necrotizing fasciitis which we could diagnosed clinically on admission. 10 patients had necrotizing fasciitis which were difficult to differentiate from cellulitis like soft tissue infection whose clinical diagnoses were delayed until features of sepsis develop.

Case fatality rate reported in the literature varies widely. A systemic review shows it's up to 34%[8]. Mortality rate in our study was 42% [n=10]. Among 14 patients who were diagnosed on admission, 3 patients died. Death rate was 21%. Among 10 patients whose diagnoses got delayed, 7 patients died. Death rate was 70%. Mortality rate in patients who were diagnosed on admission is significantly low compared to the patients whose diagnosis was delayed [p<0.01].

Plain x-rays are not routinely used with a diagnostic intention in necrotising fasciitis. But presence of soft tissue gas in a radiograph with clinical features suggestive of soft tissue infection is highly suggestive for necrotizing fasciitis[9]. Although CT is much more sensitive than plain radiographs in identifying soft tissue gas, it is not freely available, especially in a level 2 hospital in Sri Lanka. Conversely plain radiographs are freely available, less time consuming and result in less radiation exposure. In several previous studies with similar interest we identified presence of soft tissue gas

in plain x-rays were ranging from 20% to 50%[5]. Percentage of patients in our study who had soft tissue gas in the plain x-rays [54%] was similar to the previous studies. Out of 10 patients whose diagnoses were delayed due to atypical presentations, 6 patients' plain x-rays were positive for soft tissue gas. Here in our study we did plain x-rays only after clinical diagnosis of necrotizing fasciitis. But if we could have done those x-rays as a diagnostic aid in those atypical cases, we could have diagnosed and intervened early in a certain number of patients.

Our study and similar previous studies show most of necrotizing fasciitis patients have high WBC count which is more than 15,000 and high CRP value which is more than 150[3]. As in other previous studies, our study also showed accompanying diabetes in this infection at a higher percentage.

In 9 cases the cause was monobacterial, with a predominance of *Pseudomonas aeruginosa* in 5 cases, where as in 15 cases cause was polybacterial with a predominance of *Streptococcus*, *staphylococcus* and *enterobacteriaceae*. Similar results were found in other studies also.[7]

With our study we recommend to use basic laboratory investigations including high WBC count, high CRP value, risk factors such as presence of diabetes, advanced age together with presence of soft tissue gas in plain x-rays as a diagnostic aid for atypical presentations of necrotizing fasciitis. And it is possible to develop a cost effective diagnostic score for resource poor settings, which need to be validated in future studies for the early diagnosis of necrotizing fasciitis in difficult cases.

Limitations

The study was conducted as a retrospective observational study. We included here only the patients who were diagnosed to have necrotizing fasciitis and analysed common findings among them. But to analyse the results in a much more objective way, a control group of people who has similar presentation but not diagnosed to have necrotizing fasciitis is needed. Additionally the sample size was small. Therefore future studies with case control design are necessary to confirm the findings and to formulate a score for early diagnosis of necrotizing fasciitis in atypical presentations.

Conclusion

A high clinical suspicion of necrotizing fasciitis is needed in an elderly patient presenting with soft tissue infection causing swelling, pain and erythema, with co-morbidity of diabetes. High WBC, High CRP and presence of soft tissue gas in plain

x-rays are highly suggestive for underline necrotizing fasciitis. Combining all those findings together will aid in early diagnosis and to formulate a better diagnostic score for the diagnosis of necrotising fasciitis which need to be validated in further studies. Early surgical debridement is the mainstay of treatment.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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A retrospective analysis of early stoma complications

Valbona Bilali¹, Ilirjana Zekja¹, Ibrahim Bruka², Helidon Nina³, Sokol Bilali²

¹ Faculty of Technical Medical Science, University of Medicine, Tirana, Albania

² Department of General Surgery, University Hospital Center “Mother Teresa”, Tirana, Albania

³ Department of Oncology, University Hospital Center “Mother Teresa”, Tirana, Albania

Keywords: Stoma complication; malignancies; colostomy; ileostomy; stoma care

Abstract

Introduction

Colorectal cancer is among the most commonly occurring malignancies and it is often associated with a high morbidity and mortality rate. Although significant advances have been made in ostomy surgery since the late 1800s, early postoperative complications may still occur. This study aimed to determine the prevalence of early stoma complication in our surgery clinic.

Methods

In this paper, we studied 314 consecutive patients who were admitted to the hospital for stoma creation, as emergency or elective procedures.

Results

The most common indication for stoma creation was colorectal carcinoma. The more frequently used surgical interventions were low anterior resection with diverting (loop) ileostomy (161 patients, 51.2%) followed by proximal defunctioning colostomy (54 patients, 17.2%) and abdominal perineal resection with end colostomy (52 patients, 16.6%). Ostomy-related complications developed in 121 patients (38.5%).

Conclusion

Our findings indicated that early stoma complication rates were higher in patients with malignancies and permanent stomas.

Introduction

A stoma is a Greek word meaning “mouth or opening” [1]. The stoma is a surgically-created opening of the intestine (colostomy and ileostomy) or urinary tract (urostomy) on the front wall of the abdomen that allows the expulsion of faeces or urine from the body into a pouch or another collection

device [2]. Colorectal cancer is among the most commonly occurring malignancies and it is often associated with a high morbidity and mortality rate. Unfortunately, colostomy continues to be the necessary treatment option in a large number of patients.

Although surgical techniques have evolved a lot, there is still a considerable occurrence of stoma complications. It's estimated that 25-60% of patients still suffer from complications. Such complications affect patient quality of life and increase the health care cost, as shown in prospective research and audits [3-7]. Stoma performance is a health-saving or life-saving surgery most frequently performed between the 5th and the 7th decades of life.

The postoperative period can manifest many problems for stoma patients, including not only health problems but also psycho-emotional changes due to stress, financial costs, lifestyle changes, stoma bag adaptation etc.

Usually, these complications include superficial or deep stoma necrosis, dermatitis, mucocutaneous separation, retraction, bleeding, and parastomal abscess [8-11].

One of the immediate actions of the early postoperative period is the evaluation of the stoma. This assessment should focus on two aspects; first the possible complications of the stoma such as stomal necrosis, superficial and deep mucocutaneous separation, retraction and dermatitis and second the psycho-emotional evaluations of the patient and his adaptation to the new health situation.

Expected outcomes in the preoperative period included well-informed patient, marked stoma site and a manageable level of anxiety.


The goal of our study was to analyze the prevalence of early stoma complications and classify the risk factors because only in this way we will be able to prevent them.

Materials and Methods

We collected and retrospectively analyzed the medical data of 314 consecutive patients who were admitted to the General Surgery Clinic at the University Hospital Center “Mother Teresa”, in the period from January 2014 to December 2018.

Correspondence: Sokol Bilali

E-mail: sbilali@hotmail.com

 <https://orcid.org/0000-0001-6877-8378>

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For all the patients included in the study are analyzed both, the data collections (gender, age, BMI, lifestyle, profession, heredity) and the history of comorbidities, history of the treatment of patients with chemotherapeutic preparations or use of radiotherapy sessions. Also considered type of stoma and if the stoma was temporary or permanent.

Before leaving the hospital, patients and their families are given a necessary instruction for home care, including diet, personal hygiene, the way of changing stoma bag, reducing strenuous physical activity by encouraging more walks in the fresh air to minimize the stress.

Despite the advice given, patients were usually seen at least two times during the first month following surgery, assessing and recording any expected changes or not of their health condition.

The follow-up of patients in this period was carried out also by a nurse stoma therapist.

Data were collected on a spreadsheet and entered into a software program (SPSS Inc., Chicago, IL). Data analysis was performed using SPSS 18 for Windows (SPSS Inc., Chicago, IL). All statistical tests were considered significant at $P < 0.05$.

Results

Our study included 314 patients, of whom 178 were female (56.7%) and the remaining 136 patients were male (43.3%). The mean age of patients taken in the study varies 53.5 ± 15.4 years. Of all the patients only 45 (14.3%) had BMI < 18.5 while 113 patients (36%) had BMI 18.5 to ≤ 29.9 and 156 patients (49.7%) had a BMI \geq of 30. Table 1 presents the diagnoses of all the patients taken in our study. As can be seen from the table, the dominant diagnosis in patients who had a stoma, were colorectal carcinoma (249 patients, 79.3%).

Table 1. Diagnosis of patients

Diagnosis	n (%)
Elective operation for colorectal carcinoma	249 (79.3%)
Inflammatory bowel disease	15 (4.8%)
Familial adenomatous polyposis coli	4 (1.3%)
Ileus due to colon carcinoma	45 (14.3%)
Bowel perforation due to colon carcinoma	1 (0.3%)

Table 2. Types of surgical intervention

Surgical Intervention	n (%)
Anterior/low anterior resection + loop ileostomy	161 (51.2%)
Low anterior resection + end colostomy	54 (17.2%)
Abdominal perineal resection + end colostomy	52 (16.6%)
Total colectomy + end ileostomy	32 (10.2%)
Left hemicolectomy + end ileostomy	9 (2.9%)
Right hemicolectomy + end ileostomy	6 (1.9%)
Total	314 (100%)

Table 2 presents the types of surgical interventions for all patients included in our study. As seen from the table, the more surgical procedure used were Anterior / low anterior resection + loop ileostomy in 161 patients (51.2%). Meanwhile, the least surgical procedure used were Right hemicolectomy + end ileostomy in only 6 patients (1.9%).

Table 3. Distribution of early stoma complications

Complications	n (%)
Superficial mucocutaneous separation	64 (20.4%)
Dermatitis	29 (9.3%)
Retraction	16 (5%)
Superficial necrosis	7 (2.2%)
Deep mucocutaneous separation*	5 (1.6%)
Total	121 (38.5%)

**Separation of the stoma from skin up to fascia*

Table 3 gives a more detailed overview of stoma complications assessed in the first 30 days after surgery. Based on the evaluation of the data, it is noted that stoma complications were found in 121 patients (38.5%). The most common complication was Superficial mucocutaneous separation in 64 patients (20.4%) and the least common was Deep mucocutaneous separation in only 5 patients (1.6%).

Table 4 shows the distribution of complications in the patients with respect to age, gender, BMI, comorbidity, and undergoing neoadjuvant chemo/radiotherapy. As shown in table 4, stoma complications were observed more in malignant diseases (33.8%) than in benign diseases (4.7%). Meanwhile, it was noticed that cardiac pathologies (38.2%) and diabetes mellitus (34%) had a significant impact on the occurrence of stoma complications. Patients who underwent radiotherapy (32.7%) were more at risk for stoma complications than those who underwent chemotherapy (8.3%).

Also, stoma located in the right lower abdominal quadrant (24.8%) were more significantly higher to that of those with stoma in the left lower abdominal quadrant (13.7%).

Table 4. Patient, surgery and stoma characteristics

Variable	Category	Complications	
		No	Yes
Gender	Male	95(30.3%)	41(13%)
	Female	119(37.9%)	59(18.8%)
Malignancy	Malignant	189(60.2%)	106(33.8%)
	Benign	4(1.3%)	15(4.7%)
Comorbidity	Diabetes mellitus	207(66%)	107(34%)
	Cardiac disease	194(61.8%)	120(38.2%)
	Respiratory disease	249(79.3%)	65(20.7%)
Stoma location	Right lower quadrant	121(38.5%)	78(24.8%)
	Left lower quadrant	72(23%)	43(13.7)
Neoadjuvant therapy	Radiotherapy	68(40.5%)	55(32.7%)
	Chemotherapy	31(18.5%)	14(8.3%)
Type of stoma	Loop Ileostomy	83(26.4%)	78(24.8%)
	End Ileostomy	33(10.5%)	14(4.5%)
	End Colostomy	32(10.9%)	74(23.6%)

Discussion

Patients with colorectal cancer who undergo surgery and are subsequently left with a permanent ostomy deserve special attention. Besides the psychological impact of the malignancy, the stoma itself affects the patient in several ways.

The patients care in the preoperative period, according to the International Ostomy Association, should focus not only on physical preparation by clearly defining the side and location of the stoma but also on psychological preparation for what awaits the patients in the postoperative period [12,13].

Another aspect impacting the quality of life in stoma patients involves skin issues, such as skin irritation (due to the close contact with stoma effluent) and the use of skin care products under the adhesive. However, if skin irritation is experienced, regular visits to the stoma care clinic could ensure optimal stoma skin management [14,15]. Studies focusing on the complications after ostomy surgery have shown complication rates between 21-70% and peristomal dermatitis was observed in several cases by Shabbir et al. [8]. Dermatitis is one of the stoma complications from frequent appliance changes were encountered in 29 patients (9.3%). Park et al. reported that peristomal skin irritation ranges from 3 to 42% [16].

In our study, a significant number of early stoma complications were observed in 121 patients (38.5%). In the study of Duchesne et al. [17] were reported 25% of 164 stoma patients while in another study, Robertson et al. [18] stoma

complications were encountered in 23.5% of 408 stoma patients.

In terms of gender, women were more predisposed (18.8%) to stoma complications than men (13%). Ponczek et al. in their prospective study involving 3970 stoma patients, noticed a greater tendency of females for stoma complication than males [13].

Our study revealed that stoma complications were observed more in malignant diseases (33.8%) than in benign diseases (4.7%). Also, Nastro et al. had reported similar findings in their study [19].

In our study, it was found that the largest number of complications were in ileostomy than in colostomy, in 92 patients (29.3%) vs 74 patients (23.6%). These results can be attributed to a higher number of patients treated with an ileostomy than colostomy. While some retrospective and prospective studies have revealed reverse results, noticing a greater number of complications in colostomy than in ileostomy [20-22]. Among the types of ileostomy, it was noticed that complications in loop ileostomy were more frequent than end ileostomy, respectively 78 patients (24.8%) vs 14 patients (4.5%). The same findings have been observed in the study of Williams et al. [23].

Previous studies have shown that the stoma site is another factor that affects stoma complications. In these studies, it is emphasized that the appropriate marking of the stoma site in the preoperative period is a necessary action that affects the minimization of stoma complications [16,24].

Conclusion

Our findings indicated that early stoma complication rates were higher in patients with malignancies, permanent stomas, and loop ileostomies. Radiotherapy conferred a higher risk for stoma complications than chemotherapy. Meanwhile, the history of comorbidities like cardiac pathologies and diabetes mellitus had a significant impact on the occurrence of stoma complications. Prospective, randomized controlled studies are warranted to further elucidate the factors that influence stoma complication rates.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Perioperative pulmonary complications: can they be predicted and minimized?

Yamuna Rajapakse¹, Lakmali Amarasiri²

¹Department of Anatomy, Faculty of Medicine, University of Colombo

²Department of Physiology, Faculty of Medicine, University of Colombo

Keywords: Perioperative; pulmonary; COVID-19

Abstract

Patients undergo surgery for various reasons. A main concern for the surgeon and anaesthetist is the occurrence of pulmonary complications during and after surgery. Perioperative pulmonary complications are more frequent in patients with compromised pulmonary function. If there is a possibility to predict such complications, necessary precautions could be taken, and the patients could be optimized to ensure that such complications are minimized. A better understanding of the physiological changes and risk factors predisposing to perioperative pulmonary complications is essential to develop strategies for reducing these complications. The resulting reduction in morbidity and mortality would lead to improvement of quality of life and reduced costs.

This article aims to make the surgeon aware of the possible surgery and anaesthesia related physiological derangements, and human and environmental factors in the operating theatre that can contribute to perioperative respiratory complications in patients undergoing surgery that is not directly related to the lungs. It stresses on the importance of actively looking for unseen and underlying physiological, pathological, patient and drug related factors to minimize perioperative pulmonary complications, highlighting important considerations in patients with underlying pulmonary disease.

Introduction

Annually approximately 300 million people undergo surgery worldwide [1]. Perioperative pulmonary complications are a cause of significant morbidity and mortality with such patients having longer duration of hospital stay. They occur more frequently than cardiac complications [2]. Such complications arise due to patient factors and effects of surgical procedures, anaesthesia, the surgical environment or pharmacological interventions during the procedure [3]. Poor pain relief, sedation and increased ventilatory demands

in the cold environment exacerbate these effects [4, 5]. When the load on the respiratory system exceeds capacity, failure will occur.

The risk for perioperative pulmonary complications depends on the site of surgery and whether it is elective or emergency surgery. The risk increases if the patient has underlying comorbidities and pre-existing pulmonary diseases such as asthma, interstitial lung disease (ILD), chronic obstructive pulmonary disease (COPD) and obstructive sleep apnoea (OSA) and, if the surgical process is directly related to the pulmonary system [5, 6]. These risks are more in extremes of age, obesity and smokers [5]. Other commonly overlooked risk factors in the 'apparently healthy' are atopy [7] and gastro-oesophageal reflux disease (GORD) [8]. The risk of postoperative complications can be reduced by postponement of surgery in patients who have reaspiratory infections or have incompletely treated pulmonary disease or comorbidities [6].

This article provides answers to frequently asked questions regarding perioperative pulmonary complications and also discusses special considerations in patients with respiratory infections including COVID-19 and tuberculosis, OSA and those on long term steroid use.

What are the commonly occurring perioperative pulmonary complications?


These include hypoxaemia, atelectasis, aspiration pneumonitis, bronchospasm, pleural effusion, pneumothorax, pneumonia, exacerbation of pre-existing pulmonary conditions, respiratory infections, pulmonary embolism, acute respiratory distress syndrome and respiratory failure [5, 9].

How does surgery affect pulmonary function?

Direct or indirect effects of surgery can lead to respiratory muscle dysfunction. Location of surgical incisions, length of the surgery, post-surgical deconditioning, procedures causing neurological damage or dysfunction can lead to respiratory muscle dysfunction, reducing tidal volume (TV), vital capacity (VC), and total lung capacity (TLC) [4, 10]. Insufficient cough and insufficient inspiratory effort due to pain following surgery can lead to atelectasis, reduce

Correspondence: Yamuna Rajapakse

E-mail: yamunanb@yahoo.com

 <https://orcid.org/0000-0002-5583-2977>

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functional residual capacity and lead to ventilation-perfusion mismatch. Atelectasis is a factor that predisposes to pulmonary infections [5, 11]. However, procedures such as lung transplantation and lung volume reduction may actually improve the function of the respiratory muscles and oxygenation [12].

Surgeries that are considered as high risk to the patient include thoracic surgery, abdominal surgery (upper more than lower), aortic aneurysm repair, neurological surgery, vascular and head and neck surgeries. Surgery where the duration exceeds two hours and emergency procedures also increase the risk of pulmonary adverse events [5, 13].

What are the physiological derangements in pulmonary function that may occur during anaesthesia?

Physiological derangements are more common during general anaesthesia (compared to regional anaesthesia) and with use of long-acting muscle relaxants. Inspiratory capacity and expiratory reserve are reduced and cough efficiency temporarily decreased during high lumbar and thoracic segment blockage [14]. Physiological derangements that arise as a consequence of general anaesthesia are given in table 1. These include effects of intubation, anaesthetic agents and effects attributable to the patient's position during anaesthesia [5, 11, 14].

How can perioperative pulmonary complications be predicted?

A thorough preoperative medical history and physical examination combined with investigations are important steps that help identify risk factors associated with perioperative pulmonary complications [13]. Preoperative risk stratification using risk prediction models takes into consideration non-modifiable and modifiable risk factors (based on history and examination), type of surgery and preoperative investigations. ARISCAT (Assess Respiratory Risk In Surgical patients in Catalonia) and PERISCOPE (Prospective Evaluation of a Risk Score for postoperative pulmonary complications in Europe) are such models [5]. However, first time drug allergy or errors in drug administration can very rarely occur during surgery despite thorough preoperative assessment [15].

What are the patient-related factors that increase risk of perioperative pulmonary complications?

Important information to be elicited by a thorough medical history is given in table 2, including demographic parameters, symptoms, exposure and habits, exercise capacity, and presence of comorbidities and allergies. Often overlooked conditions such as atopy, wheezing (in childhood, in response to infections or cold) and GORD need to be specifically sought [5, 7, 8, 13, 14].

What are the important features that should be looked for during physical examination?

A thorough examination of general appearance and the cardiorespiratory system is essential, including measurement of height and weight [5,13]. Important features to note are mentioned in table 3.

What are the investigations that assist in predicting perioperative pulmonary complications? [5, 12, 14]

Table 4 lists investigations that are routinely performed to predict risk of perioperative complications in high risk surgeries and in those with compromised pulmonary systems [5, 13]. Prior to performing such investigations, factors such as whether the outcome would influence the decision to postpone or cancel surgery, the risk versus benefit and the cost of the test are taken into consideration.

Do pulmonary function tests (PFTs) need to be performed routinely before surgery?

Routine spirometry assessment prior to surgery is generally not recommended in non-thoracic surgery or in individuals with no known or suspected pulmonary disease [16]. PFTs in these situations are unlikely to influence the decision whether the surgery should be performed or to alter perioperative management. The guidelines states that even patients who undergo major surgery and who are of American Society of Anesthesiologists (ASA) grade 3 or 4 because of known or suspected pulmonary disease should be tested only after seeking advice from a senior anaesthetist. Such patients are likely to have already undergone investigation or treatment by respiratory specialists. If they have not been assessed, then PFTs should be performed [16].

In surgeries where pulmonary parenchymal resection is planned, PFTs are of value. In pneumonectomy, preoperative spirometry, diffusing capacity (DLCO) and lung perfusion scintigraphy are used to calculate percent predicted postoperative values [12].

What PFTs are commonly performed to predict perioperative pulmonary complications?

Arterial blood gas analysis and oxygen saturation (SPO₂) estimation on room air, and spirometry are the most common PFTs to be performed prior to cardiothoracic surgery [12]. Spirometry which measures inhaled and exhaled lung volumes and flow over time, is used to diagnose airway obstruction and restriction and to grade severity in those with suspected pulmonary disease. A postbronchodilator FEV₁/FVC ratio of < 70% on spirometry confirms COPD in a patient with airway obstruction (GOLD criteria) and reversibility indicates asthma [17]. Spirometry is also combined with static lung volumes and DLCO values in risk assessment (table 5) [12]. An abnormal preoperative

Table 1. Physiological derangements due to general anaesthesia

Effect of anaesthesia	Physiological derangement
Endotracheal tube, mucosal swelling	increased airway resistance in upper airways
Reduced chest wall and diaphragm tone	atelectasis
Reduced tone of the upper airway muscles	airway collapse
Reduced lung compliance	increased work of breathing
Supine or lateral position Surgery	reduced tidal volume and functional residual capacity early airway closure V/Q mismatch
Sedation from opioids or hypercapnia	Central respiratory depression
Prolonged exposure to anaesthetics	Impairment of ventilatory response to hypoxia and hypercapnia and acidosis Inhibition of hypoxic pulmonary vasoconstriction Depression of cough reflex Temporary immunosuppression and decreased mucociliary clearance
Bronchodilation/ bronchoconstriction	

Table 2. Patient-related factors that increase the risk of perioperative complications

	Patient factor
Physiological factors	Extremes of age and pregnancy
Symptoms	Cough, shortness of breath (at rest and in response to activity), dyspnoea, recent infections (within 1 month) Daytime sleepiness, snoring, episodes of observed apnoea Increasing (fluid retention) or decreasing weight (malnutrition/protein deficiency/>10% weight loss in the preceding 6 months) Cardiac angina
Exposure	Pulmonary toxic medications (bleomycin, amiodarone, etc.) Environmental/occupational contamination (coal dust, secondhand smoke, asbestos, etc.) Tobacco use/ exposure to secondhand smoke fuel Alcohol use
Exercise capacity	Inability to perform activities of daily living without assistance or live independently Self- estimate of ability to climb 2 flights of stairs or walk approximately 0.4 miles or 350-400 m at a reasonable pace (3.5 miles/h) without shortness of breath is essential for elective surgery Features of heart failure
In the apparently normal	Atopy (known or suspected), childhood wheezing, allergic rhinitis, syncopal attacks, gastro oesophageal reflux, exercise or cold induced wheezing or cough
Allergies	History of known or suspected allergies
Comorbidities	COPD, asthma Long term steroid use Congestive heart failure Metabolic abnormalities Neuromuscular defects Obstructive sleep apnoea Obesity Diabetes mellitus Hypertension Malignancies Chronic liver disease Renal failure Endocrine disorders Pulmonary hypertension

Table 3. Physical signs to be observed to predict risk of perioperative complications

General appearance	Muscle wasting, size of oral opening, visibility of uvula and palate, mobility of cervical spine, condition of teeth, thyromental distance, neck circumference, digit clubbing, cyanosis, shape of the thorax
Height and weight	Body mass index
Respiratory system	A thorough airway examination: respiratory rate and pattern respiratory effort during conversation and with movement, signs and symptoms of obvious lung and lung related conditions, diminished respiratory sounds, dullness to percussion, laryngeal height, Positive cough test (where the patient coughs involuntarily after deep inspiration)
Cardiovascular system	Features of heart failure

Table 4. Investigations performed to predict risk of perioperative complications

Blood tests	Serum eosinophils Serum total IgE Blood urea Serum haemoglobin Serum albumin Serum creatinine Liver function tests
Radiology	Chest radiograph Lung computerized tomographic scan (especially High-resolution CT) and MRI are performed only if there is clinical suspicion of a condition that could affect decision-making in the perioperative period
Pulmonary function tests	See table 5 and 6

Table 5. Spirometry parameters and information obtained useful in assessment of suitability for surgery

Parameter	
Reduced FVC, VC or TLC	Indicative of restrictive disease
FEV ₁ /FVC ratio <70% and FEV ₁ <80% of predicted	Indicative of obstructive lung disease
Post bronchodilator FEV ₁ /FVC ratio of <0.70	Diagnostic of COPD
Obstructive spirometry values and reduced DLCO	Indicative of emphysema
Maximal voluntary ventilation	To assess exercise tolerance and respiratory muscle endurance
Flow volume loops*	To evaluate airway obstruction To differentiate between fixed and variable (intra- and extra thoracic) obstruction

FVC, Forced Vital Capacity VC, Vital Capacity TLC, Total Lung Capacity

FEV₁, Forced Expiratory Volume in the first second of FVC

FEV₁/FVC, Ratio of FEV₁ to FVC

DLCO, Diffusing Capacity of the Lung for Carbon Monoxide

*These can be helpful in the workup of patients with unexplained dyspnoea, stridor, suspected tracheal stenosis and vocal cord pathology

Table 6. Protocol for the preoperative objective assessment of COVID-19 survivors, stratified based on nature of planned surgery and degree of index illness [24].

Step/ test	Minor procedures and/or without general anaesthesia		Major procedures	
	Asymptomatic	Symptomatic	Asymptomatic	Symptomatic
CXR	No—if pulmonary exam and SpO2 normal	No—if pulmonary exam and SpO2 normal	Yes	Yes
ECG	Yes	Yes	Yes	Yes
Echo	No—if cardiac exam and vitals normal	No—if cardiac exam, NT-pro-BNP, and vitals normal	No—if cardiac exam, NT-pro-BNP, and vitals normal	Determined by H&P
CMP	Yes	Yes	Yes	Yes
FBC with DC	Yes	Yes	Yes	Yes
PTT	No	Consider based on severity of illness	Yes	Yes
D-dimer	No	Yes	Yes	Yes
Fibrinogen	No	Consider based on severity of illness	Yes	Yes
NT-Pro-BNP	No	Yes	Yes	Yes
LDH, Ferritin, prealbumin	No	Consider based on severity of illness	No	Consider based on severity of illness

CXR, Chest X ray
H&P, History and physical examination
CMP, Comprehensive metabolic panel
NT-Pro-BNP, N-terminal (*NT*)-*pro* hormone brain type natriuretic peptide
ECG, Electrocardiogram
DC, Differential count
PTT, Prothrombin time
Echo, Echocardiogram
FBC, Full blood count
LDH, lactate dehydrogenase

Table 7. Perioperative steroid management in patients on high doses of steroids for interstitial lung disease or sarcoidosis, requiring surgery [34]

	Intra-operative steroid replacement	Postoperative steroid replacement
Major surgery	Hydrocortisone 100 mg intravenously at induction, followed by immediate initiation of a continuous infusion of hydrocortisone at 200 mg.24 h ⁻¹ ; Alternatively, dexamethasone 6–8 mg intravenously, if used, will suffice for 24 h	Hydrocortisone 200 mg.24 h ⁻¹ by iv infusion while nil by mouth (alternatively, hydrocortisone 50 mg every 6 h by im injection) Resume enteral glucocorticoid at double the pre-surgical therapeutic dose for 48 h if recovery is uncomplicated. Otherwise continue double oral dose for up to a week
Body surface and intermediate surgery	Hydrocortisone 100 mg, intravenously at induction, followed by immediate initiation of a continuous infusion of hydrocortisone 200 mg.24 h ⁻¹ Alternatively, dexamethasone 6–8 mg intravenously, if used, will suffice for 24 h	Double regular glucocorticoid dose for 48 h, then continue usual treatment dose if uncomplicated
Bowel procedures requiring laxatives/enema	Continue normal glucocorticoid dose. Equivalent iv dose if prolonged nil by mouth Treat as per primary adrenal insufficiency if concerned about hypothalamo-pituitary-adrenal axis function, and risk of adrenal insufficiency	
Labour and vaginal delivery	Hydrocortisone 100 mg intravenously at onset of labour, followed by immediate initiation of a continuous infusion of hydrocortisone 200 mg.24 h ⁻¹ Alternatively, hydrocortisone 100 mg intramuscularly followed by 50 mg every 6 h intramuscularly	
Caesarean section	See major surgery	

spirometry result alone should not deter patient from undergoing planned surgery. In such an event, assessment of risks versus benefits in consultation with relevant specialists should be done [16].

What are the other PFTs that are useful in pre-operative assessment in a patient with known or suspected pulmonary disease?

Static lung volumes are useful to detect hyperinflation of the chest in patients with COPD and DLCO helps to differentiate intrinsic from extrinsic restrictive (neuromuscular, chest wall and pleural) disease. Exercise tests such as six-minute walk test (6MWT), incremental shuttle test and cardiopulmonary exercise testing (CPET) assess the exercise capacity of an individual and indicate the physiological cardiorespiratory reserve that may be available after surgery. Maximal inspiratory and expiratory pressures (MIPs and MEPs) and sniff nasal inspiratory pressure (SNIP) are useful in assessment of respiratory muscle function. Bronchial challenge tests such as bronchoprovocation and exercise challenges are useful to detect compromised lung function in those with normal PFTs, yet with high clinical suspicion. For those who require air travel for surgery, it would seem prudent to assess fitness to fly [5, 6, 12].

How can perioperative pulmonary complications be minimized?

The following perioperative care interventions are carried out in clinical practice [3,5, 6, 7, 8, 14, 18], though some lack best quality evidence regarding reducing complications [18].

Box 1: Pulmonary function test parameters and reference values that indicate low risk for perioperative pulmonary complications [5, 6, 12, 13, 16]

FEV₁/FVC or FEV₁/VC >80%
FVC or VC >80% with <20% fall when subject lies supine
FEV₁ > 80%
MVV >50%
DLCO >=70%
MIP and MEP > 80cm H₂O
SNIP >70cm H₂O
SpO₂ >95%
VO₂max <20 ml/kg/min
Desaturation <4% with exercise

Before surgery

Identification of the “high-risk” patient

Preoperative optimization of comorbidities and respiratory infections

Optimal treatment for COPD, asthma, bronchiectasis and interstitial lung disease

Preoperative bronchodilator therapy in those with a FVC < 1 L or a FEV₁ < 500 cm³, especially if improvement occurs

after treatment.

Perioperative steroid management

Smoking cessation (at least 8 weeks prior to elective surgery)

Correction of anaemia

Preoperative respiratory muscle training

At the time of surgery

Adequate analgesia

Appropriate management of neuromuscular blocking drugs

Routine use of warming techniques

Intraoperative PEEP, ventilation regimes

Extubation in a sitting up posture (where possible)

Intraoperative use of antiemetics and prokinetics

After surgery

Early commencement of chest physiotherapy and steam inhalation

Oral hygiene

Early mobilization

Adequate pain relief

Appropriate fluid resuscitation and fluid balance

Continuation of patient's usual inhaler medication with added nebulizer as needed

Postoperative respiratory support with CPAP and nasal high-flow oxygen where required.

Is preoperative respiratory muscle training useful in prevention of postoperative pulmonary complications?

Improving respiratory muscle strength in patients undergoing thoracic surgery is beneficial, though there is limited effect on sustained ventilation and maximal oxygen consumption. Intermittent positive pressure breathing, incentive spirometry and deep breathing exercises are commonly utilized to prevent pulmonary complications after thoracic surgery [5, 6,].

How soon after respiratory infections can surgery be planned?

A patient with recent or ongoing upper or lower respiratory tract infection poses a dilemma in terms of timing of elective and emergency surgery. An upper respiratory tract infection (URI) in adults in the month before surgery was found to be have negative impact on postoperative outcome [19, 20], through either local or systemic effects.

Respiratory tract infections may make even normal individuals susceptible to laryngospasm, bronchial hyper-reactivity and bronchospasm, on exposure to anaesthetic gases or produce increased amounts of respiratory secretions for as long as 4-6 weeks after the infectious episode [19]. These patients are more prone to hypoxaemia, atelectasis,

collapse and pulmonary oedema increasing the risk of perioperative pulmonary complications [19]. Furthermore, a recent history of pneumonia was found to increase postoperative morbidity and mortality significantly when considering a variety of different surgical settings and patient groups [20]. In the case of general surgery, vascular surgery and thoracic surgery, special consideration needs to be given as these surgical types were reportedly most affected by preoperative pneumonia within a 30-day period [20]. Patients with acute lung infections should be adequately treated and postponement of elective surgery seriously considered until symptoms and lung function are back to acceptable levels [19, 20].

If an earlier date is required, the patient needs to be investigated similar to a known patient with asthma/bronchospasm. Sputum cultures need to be negative prior to performing PFTs, however, 6MWT is adequate to assess fitness for surgery if sputum is unavailable. In the patient requiring emergency surgery, however, it was found that in the case of preoperative pneumonia, emergency surgery showed only a mild increase in mortality [20]. The complications arising from increased airway reactivity can be minimized by using laryngeal mask airway (LMA) as an alternate technique to intubation, though it can still produce epiglottic irritation [21]. However, if intubation is mandatory, several options are available. The main treatment option advised is inhalation of sympathomimetics such as salbutamol [22]. Sympathomimetics produce more rapid and effective bronchodilation than the intravenous methylxanthine, aminophylline. Intravenous lignocaine (1.5–2 mg/kg), hydrocortisone (4 mg/kg) or glycopyrrolate (1 mg) has also been employed with good effect to help in reversing any reflex response to bronchoconstriction [22].

What is the optimal length of time between recovery from COVID-19 and elective surgery that would minimize perioperative complications?

A patient diagnosed with COVID-19 should be evaluated in regard to optimizing their medical conditions and physiologic status, if planning for surgery. Since COVID-19 has been found to affect multiple major organ systems, the timing of surgery after a diagnosis of COVID-19 is most important especially when considering the risk of peri-operative complications. Infection with COVID-19 that may have affected the lung parenchyma will manifest as restrictive lung disease and requires specific evaluation prior to planning surgery. Table 6 shows the protocol for objective preoperative assessment of COVID-19 survivors, based on the nature of surgery and degree of illness [23].

Given the current knowledge on the disease, the times to plan surgery after recovery from COVID-19 can be reasonably

estimated. The following time periods have been proposed as per literature to schedule elective surgery in patients diagnosed with and recovered from COVID-19 [23].

- Patient asymptomatic or recovered from only, mild respiratory symptoms – four weeks.
- Patient with respiratory symptoms not requiring admission – six weeks.
- Patient who has symptoms and is diabetic, immunocompromised and was hospitalized – eight to ten weeks.
- Patient who was managed in the ICU due to COVID 19 infection – twelve weeks.

The perioperative risk assessment should be individualised and factor in the type of surgery, patient comorbidities and benefit versus risk of delaying surgery [23]. Persisting symptoms, even 60 days beyond the diagnosis, such as breathlessness, fatigue and chest pain are common post COVID 19 infection. Furthermore COVID 19 may have long term effects on cardiac and respiratory function. Recovered COVID-19 patients with residual symptoms, therefore, should undergo a more thorough preoperative evaluation with special attention to the cardiopulmonary systems [24]

.In COVID-19 positive patients requiring emergency surgery, it is better to have a low threshold for intubation, especially in those who have acute respiratory failure. This should bypass non-invasive ventilation techniques (CPAP or BiPAP). This will minimize transmission risks [25]. Awake intubation techniques should be avoided. Procedures that may generate aerosolized particles have been associated with increased coronavirus transmission: eg. non-invasive ventilation, tracheal intubation, tracheostomy, and manual ventilation before intubation and bronchoscopy. An FFP3 mask should therefore be worn by all health care staff who are required to work in close proximity to the patient during these procedures [25].

What is the impact of pulmonary tuberculosis (PTB) on perioperative pulmonary complications in non-chest surgeries?

Patients with PTB are reported to have a higher risk of peri-operative complications compared to those without. These include, pneumonia, septicaemia and pulmonary embolism. Overall complications were also found to be higher [26]. Preoperative PTB was further associated with increased 30-day postoperative mortality, a prolonged hospital stay and increased rate of admission to intensive care units [26]. The reasons for this include the effects of PTB on pulmonary inflammation, altered innate immunity and complex drug interactions with anti TB medication [26].

When planning surgery for patients with PTB, a respiratory physician's opinion is invaluable. Patients with PTB become non-infectious at two weeks of anti-tuberculous treatment (ATT). After commencing treatment for PTB, sputum is examined for acid fast bacilli (AFB) and Mycobacterium tuberculosis (MTB) culture at two months when sputum smear conversion is expected [27]. Ideally, non-chest surgery, if elective, should be planned for after two months of commencing ATT [26, 27].

In the case of emergency surgery, a preoperative 6MWT in patients who are able, or oxygen saturation and ABG in patients who cannot perform 6MWT, is ideal as PFTs are contraindicated owing to PTB infection. Risk to the operating staff can be minimized by performing sputum AFB and rapid MTB culture as soon as surgery is planned, and by using personal protective equipment (PPE) and negative pressure environment for surgery [26, 27].

What is the effect of OSA on perioperative pulmonary complications?

Patients with OSA have a higher risk of perioperative pulmonary complications. Anaesthetic medication, opioids and other sedatives increase airway obstruction and hypoventilation, which in turn lead to hypercapnic respiratory failure [28]. Patients with OSA have an increased risk of being intubated postoperatively and a several-fold higher risk of being mechanically ventilated than those without OSA [28, 29]. There is also a higher risk of postoperative complications and admission to ICU as well as longer hospital stays than in those without OSA [29, 30].

OSA is generally undiagnosed, therefore, the use of the STOP-BANG questionnaire has been advised for pre-assessment screening. Depending on the results, the patient may either be referred for sleep studies and started on definitive management or recommended an alternative anaesthetic regime, for example, by using opioid sparing anaesthetic techniques and enhanced monitoring. This screening is recommended by the association of anaesthetists in the UK for all obese patients undergoing surgery [31]. Studies on obese OSA patients undergoing bariatric surgery have shown that such screening and management has improved post-surgical outcome including reduction in post-operative intensive care [28]. Screening also can predict susceptible patients who are either undiagnosed or who are resistant to continuous positive airway pressure treatment, thus enabling more intensive perioperative monitoring [28].

What is the perioperative steroid management in a patient on high doses of steroids for interstitial lung disease or sarcoidosis, requiring surgery?

Hypothalamo-pituitary adrenal axis (HPAA) suppression has

been seen in patients who take doses of prednisolone that exceed 5 mg/d long term, 7.5-10 mg/d for 1 month or 20 mg/d for 3 weeks. It is also seen in patients taking high doses of other inhaled corticosteroids for a variety of conditions [32]. Patients on such high doses of steroids at the time of planning for surgery require supplementation of corticosteroids in doses that should reflect the physiologic response of the normal adrenal gland to surgical stress. This supplementation should be for only a very short duration. Table 7 describes the perioperative steroid dosing recommendations based on the type of surgery [33, 34].

Conclusion

Perioperative pulmonary complications are common and more evident in those with compromised pulmonary function or undergoing surgery related to the pulmonary system. Knowledge of physiological derangements during surgery and anaesthesia, awareness and anticipation of human and environmental risk factors coupled with risk prediction and correction of modifiable risk factors could help minimize such complications.

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Anaesthetic implications during the COVID-19 pandemic: an appraisal of the literature

Ravindri Jayasinghe¹, Nadeeshya Welikala², Ravindi Gunaratne², Umesh Jayarajah¹, Vihara Dassanayake¹, Sanjeeva Seneviratne¹

¹Department of Surgery and Department of Anaesthesiology & Critical Care, Faculty of Medicine, University of Colombo, Sri Lanka

²Department of Anaesthesiology & Critical Care, National Hospital Colombo, Sri Lanka

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Abstract

The coronavirus disease-2019 (COVID-19) pandemic has raised many concerns regarding the safety of patients and healthcare workers. Anaesthetic implications and the impact of this pandemic on anaesthesiologists have been discussed widely in the recent past. Operating theatres are high-risk areas where anaesthesiologists perform various aerosol-generating procedures (AGPs).

Prolong patient contact predisposes them to the risk of exposure. Scarcity of resources and limitations in testing pose an additional risk to the anaesthesiologist. Although guidance from various professional bodies is in abundance, there is a general lack of consensus. This review summarises current evidence and guidelines related to anaesthesiology during the COVID-19 pandemic. Ensuring the provision of unhindered care, ensuring patient safety and protecting oneself with optimum utilization of available resources remain a challenge to the anaesthesiologist.

Introduction

SARS-CoV-2, a novel strain of coronavirus was first isolated in January 2020 while investigating an outbreak of pneumonia in Wuhan, China [1]. Since its origin, millions of cases have been confirmed positive and more than 2.5 million deaths have been reported worldwide [2]. The pandemic has had a significant impact on the healthcare system, economy and the general public [3, 4].

The impact of COVID-19 on the anaesthesiologist is considerably higher when compared to other healthcare workers due to their involvement in airway management in a high-risk environment [5]. Hospitals worldwide have taken measures to reduce the number of procedures to minimise disease transmission and to preserve both consumables and human resources [6]. Rational use of personal protective

equipment (PPE) is essential to containing the spread of infection. The objective of this review is to focus on the current practice of anaesthesiology during the pandemic and to summarise key recommendations based on consensus guidelines for anaesthesiologists.

Mode of anaesthesia: General anaesthesia (GA) vs. Regional anaesthesia (RA)


Anaesthesia for patients with COVID-19 mandates a balance between the provision of care and safety for both the patient and the anaesthesiologist. However, during the process of shared decision-making, the priority is to provide the safest and the most appropriate mode of anaesthesia for a surgical procedure to the patient. Whenever there is a doubt, patient comfort and safety should be considered as a priority. The consenting process should not be biased towards any particular modality and all information based on evidence should be provided to the patient. It is also prudent to consider the risks of disease transmission related to the mode of anaesthesia and the urgency of surgery [7].

Many potential advantages have been described concerning various modes of anaesthesia. Regional anaesthesia reduces the number of AGPs thereby saving time and cost spent on PPEs, preservation of immune function when compared with general anaesthesia, improved postoperative analgesia minimising direct contact with caregivers, and earlier hospital discharge [8]. Additionally, it has been identified that patients with acute COVID-19 infection were at an increased risk of developing postoperative pulmonary complications including ARDS [9, 10]. Overall, patients who underwent neuraxial anaesthesia had fewer perioperative pulmonary complications compared to general anaesthesia [11].

To date, no published randomized controlled trials are evaluating the reduction of risk for disease transmission brought on by regional anaesthesia when compared to general anaesthesia. Therefore, it is reasonable to consider that all the recommendations on the above have been based on logical thinking and understanding. Interestingly, a recent death review of health care workers carried out in the United Kingdom revealed that there were no reported deaths among anaesthesiologists or staff involved in critical care practices,

Correspondence: Umesh Jayarajah

E-mail: umeshe.jaya@gmail.com

 <https://orcid.org/0000-0002-0398-5197>

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where the highest number of AGPs had been carried out [8]. The reason for this is unclear but may well be attributed to the rigorous utilization of PPEs [8].

Based on the above, regional anaesthesia may be considered a suitable option where appropriate. However, the risk of conversion to GA midway during the procedure should be thoroughly evaluated beforehand and appropriate PPEs should be kept ready. It should be remembered that droplet and aerosol generation are possible while breathing, speaking, coughing and sneezing which are all possible in the awake patient under regional anaesthesia. In such patients, donning in only droplet PPEs may be sufficient. Such a situation may not arise or be minimal in a patient who is under general anaesthesia with a definitive airway in situ, which might appear to be a safer option as opposed to regional anaesthesia.

Other general standards should be given due consideration such as limiting proximity to the patient and duration of exposure, minimum of five air changes/hour, placement of a surgical mask on the patient and minimal manipulation of oxygen therapy devices. Avoidance of high oxygen flow rates will minimize the generation of aerosols.

Furthermore, with more cases being performed under regional anaesthesia there are advantages to an institution, such as efficient utilization of drugs for critical care services, reducing the time consumed per case and bypassing the time spent in the recovery area.

Due to a lack of reliable evidence, the adverse effects of regional anaesthesia on COVID-19 patients have not been fully demonstrated. Literature suggests there are minimal effects on clinical outcomes in patients undergoing regional anaesthesia [11].

Despite being commonly associated with hypercoagulability, COVID-19 is also associated with thrombocytopenia [12]. Therefore, a full blood count is mandated before providing neuraxial anaesthesia. Care needs to be taken during the insertion and removal of indwelling epidural catheters with pre-existing coagulopathy.

In patients with neurological disease, central neuraxial blocks (CNB) were thought to be safe as the coronavirus had not been isolated in cerebrospinal fluid [8]. However, with a more recently reported case of COVID-19 meningitis and detectable virus within the CSF, such evidence should be revisited [8].

During placement of peripheral nerve blocks, several key recommendations have been made by various bodies to improve quality and safety related to anaesthesia. Use of ultrasonography to perform regional blocks, use of wound infiltration catheters in case of prolonged blocks or to provide

post-operative pain relief using adjuncts to peripheral nerve blocks (PNB) along with local anaesthetics without dose modifications, can all be incorporated into current practise during the pandemic [8].

Accredited authorities of regional anaesthesia had issued guidance on neuraxial anaesthesia and peripheral nerve blocks during the COVID-19 pandemic recommending regional anaesthesia over general anaesthesia [13]. However, the possibility of a “failed block” and conversion to general anaesthesia may increase the risk of viral transmission. Therefore, careful preoperative assessment to avoid any unplanned conversions to general anaesthesia is imperative.

Pre-operative assessment and Preparation

During the preoperative assessment, it is important to weigh the risk of disease transmission and the benefit of surgery to the patient. Identifying the high-risk patient is of paramount importance [14]. It is also important to balance resource consumption and the risk of transmission of the disease to healthcare workers. Factors such as the need for critical care beds, transfusions, number of personnel required in theatre, risks associated with various modes of anaesthesia and type of surgery should all be taken into consideration [15, 16]. It is recommended to have a designated operating room for COVID-19 suspected patients and to do with the appropriate level of PPEs. Limited resources including consumables is a universal problem. The World Health Organization (WHO) recommends using N95, Filtering Face Piece-2 (FFP2) respirator or an equivalent during aerosol-generating procedures [17]. Despite guidance on PPEs, there is limited consensus related to their usage. A three-tiered approach to PPE has been recommended for airway managers. Their recommendation is to use airborne, droplet and contact precautions in combination for high-risk aerosol-generating procedures which comprise of a head cover, eye protection, N95 respirator, AAMI (Association for the advancement of medical instrumentation) level-2 or higher gown and a pair of single gloves overlapping the sleeve of the waterproof gown [17]. Droplet and contact precautions are considered adequate for most routine procedures. High-risk precautions should be used by personnel directly involved in procedures such as airway management. Limiting the number of personnel in the operating room (OR) is critical during high-risk procedures which minimises exposure [17].

It is essential to have a pre-planned team led by a senior anaesthesiologist for patients suspected or confirmed with COVID-19. Roles should be allocated preoperatively, and all members should maintain closed-loop communication. During emergency surgery, a member of the team should perform a rapid pre-anaesthetic check-in in a predesigned room within the theatre [18]. During an elective procedure,

pre-anaesthetic patient assessment could be done via telemedicine as an alternative to face-to-face consultation. Video and audio devices can be used to perform a visual examination and provide medical advice. Most routine surgeries including cardiac, vascular and thoracic surgery can potentially be performed following a telemedicine evaluation. However, there are limitations especially in patients with multiple comorbidities and technological constraints related to internet access and the level of literacy. This is a hindrance and a constant challenge to the anesthesiologist and patients seeking perioperative care in a low-middle income country, such as Sri Lanka.

Airway management

Consensus guidelines for managing the airway in patients with COVID-19 was published by the Difficult Airway Society, the Association of Anaesthetists, the Intensive Care Society, the Faculty of Intensive Care Medicine, and the Royal College of Anaesthetists [19].

Airway establishment and management may be required for asymptomatic or minimally symptomatic patients with COVID 19 in the community requiring emergency surgery for unrelated conditions [19] and controlled ventilation for patients diagnosed with viral pneumonia in the critical care unit.

Several AGPs have been identified as high-risk of dissemination of the virus during airway manipulation. These include tracheal intubation, tracheostomy, emergency front-of-neck airway (FONA), non-invasive ventilation (NIV), and bag-mask ventilation. Other possible AGPs includes tracheal extubation, disconnection of ventilatory circuits during use, performing chest compressions during cardiopulmonary resuscitation without tracheal intubation (minimal risk during defibrillation), bronchoscopy, and tracheal suctioning.

Recent studies have demonstrated that in practice, tracheal intubation and facemask ventilation produced only very low quantities of aerosolised particles. Tracheal extubation when associated with coughing produced 15 times more aerosols than intubation. Volitional coughing is associated with a very high aerosol generation [20].

To ensure safety for the anesthesiologist and other health care workers, correct use of PPEs, decontamination of surfaces and equipment, minimizing unnecessary patient and surface contact and careful waste disposal are essential elements during patient care. Double gloving may protect against fomite contamination. Training and regular simulation sessions in the use of PPEs (both donning and doffing) before patient management is beneficial [19].

To minimize the risk of airborne exposure, it is best to manage the patient in a negative pressure room with rates of air exchange amounting to more than 12 exchanges per hour. Monitoring should be established by adhering to the Association of Anaesthetists standards including the use of continuous waveform capnography.

Intubation should be performed by the most experienced member of the team to ensure success at the first attempt, safety, accuracy and swiftness in securing the airway. A tracheal intubation trolley must be prepared and be checked daily. An airway strategy including rescue plans should be briefed to the airway team before intubation. The team should comprise of an “intubator”, an assistant and a third staff member to administer drugs and to monitor the patient. A runner or buddy should be present outside the intubating bay who can call for help if required and assist in donning of team members and observe doffing once the procedure is over.

Rapid sequence induction (RSI) with cricoid pressure is recommended to secure the airway. The procedure begins with pre-oxygenation using a well-fitting mask for 3–5 min with a closed circuit. A heat and moisture exchange (HME) filter should be connected between the catheter mount and the circuit. Non-invasive ventilation and high flow nasal oxygen should be avoided. Ketamine can be used as an induction agent to avoid cardiovascular collapse provided that there is no contraindication. Rocuronium (if sugammadex is available) or succinylcholine is used as neuromuscular blockers and complete paralysis must be confirmed before attempting intubation. Face mask ventilation should be avoided during apnoea. Continuous positive airway pressure (CPAP) may be applied. If mask ventilation is necessary to prevent hypoxemia, 2-hand, 2-person technique with a VE grip should be used.

The use of a video-laryngoscope is advocated as the operator can maintain sufficient distance from the patient's airway during tracheal intubation and achieve prompt first-pass tracheal intubation. The tracheal tube has to be placed without losing sight of it on the screen and the cuff is passed 1–2 cm below the cords for optimal positioning. The cuff is inflated to 20-30 cmH₂O. Mechanical ventilation is commenced only after cuff inflation. Correct placement of the tracheal tube is then confirmed with continuous waveform capnography. Auscultation to confirm tube placement is not recommended. Visual observation of equal bilateral chest wall expansion, lung ultrasound or chest X-ray can also be done to confirm the correct placement of the tube.

A ventilator dedicated for COVID-19 positive patients in the OR has also been recommended which would minimize cross-contamination [21]. The use of barrier-enclosure

systems, such as aerosol boxes and plastic drapes have been developed to act as a shield during endotracheal intubation while allowing enough mobility during intubation. Its use may complicate airway management with potential adverse events, particularly during airway emergencies. Concerns include the limited ability for interventions, limited access to support during intubation by the assistant, damage to the PPE of the “intubator”, injuries to the patient and secondary aerosolization during barrier removal. There is no clear evidence to suggest additional protection for HCWs and there is no standard for cleaning such equipment. Enclosure barriers cannot substitute adequate use of PPEs and further studies are required for validation [22].

Perioperative management and extubation

Adherence to the prevention of infections is mandatory during the intraoperative period. As a policy for infection control, it is recommended that only one anesthesiologist should use the workstation and it should be covered with disposable transparent drapes. Frequent intraoperative suctioning should be avoided and low-flow anaesthesia should be used for maintenance to reduce viral transmission [18].

Tracheal extubation should be performed inside the operating theatre with limited HCWs and efforts taken to minimize coughing due to increased aerosol generation. Use of supraglottic airway as a bridging technique or use of medications such as dexmedetomidine, lidocaine and opioids which suppresses cough may be considered to achieve smooth extubation. However, the safety of these procedures in the setting of the COVID-19 pandemic has not been proven. Tracheal suctioning through a closed suction apparatus and oral suctioning can be performed as usual. There should be equipment available to provide low flow nasal oxygen (< 5 litres/ min) or face mask oxygen before extubation to ensure the immediate connection of the patient to their oxygen mask or nasal cannula [19]. If extubation is deferred, the patient transfer should take place using a transport ventilator with an HME (heat and moisture exchanger) filter connected to the patient end [18].

Recovery and post anaesthesia care

Patients should be taken to a designated recovery room following extubation. The patients should wear surgical masks before leaving the theatre. Congestion in the recovery area should be avoided and experts recommend maintaining at least a one-meter distance between patients [23]. After leaving the theatre, it is recommended to keep the patient in an isolated room. However, due to overwhelmed resources, this may be impractical in many centres.

All used PPE s should be disposed into biohazard bags keeping with the local infection control policy. It is mandatory to avoid contamination during the doffing of PPEs. This could be achieved by having an observer/buddy to guide safe doffing [24]. Decontamination of the theatre and equipment should follow hospital policy. All clinical waste should be clearly labelled, double bagged and sealed. It is then sprayed with chlorinated disinfectant and covered with an additional bag. Single-use laryngoscopy blades, breathing circuits, masks, HME filters, tracheal tubes, gas sampling lines and soda-lime needs to be discarded [25]. Agents that are used for decontamination include, vaporized Glutaraldehyde (ANIOS) or hydrogen peroxide generator (VHPG), 1% sodium hypochlorite solution, and 75% alcohol. Metallic equipment must be kept immersed in 1% sodium hypochlorite for 30 minutes and then washed and wiped [25]. The operating theatre should be cleaned and disinfected between surgeries. The disinfecting personnel must enter the theatre only after adequate air changes have been completed to remove infectious particles. Staff must be aware of the COVID status of the patient and must handle equipment only after wearing full PPE [26]. All floors and walls should be cleaned with 1% sodium hypochlorite solution [25]. The theatre can be disinfected with UV light after chemical disinfection [26].

Conclusion

The ongoing pandemic is causing a dramatic shift in the role of healthcare workers in their diverse specialities. Anaesthesiologists are placed at high risk due to manipulation of the airway and dealing with AGPs. Hospitals should develop a detailed pandemic preparedness plan addressing major concerns such as limitation of resources, staff well-being and safety, and implementation of strict measures of infection control. Current guidance is mostly based on expert opinion. High-quality multicentre research is deemed essential to formulate evidence-based healthcare policy changes both locally and internationally.

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The need for trainee-led surgical research collaborative in Sri Lanka

Umesh Jayarajah, Oshan Basnayake
Postgraduate Institute of Medicine, University of Colombo, Sri Lanka

Keywords: Research collaborative; trainee-led research; surgical research

Introduction

The value of medical research in the undergraduate and postgraduate medical curriculum is increasingly recognised [1]. Many professional medical bodies promote undergraduate and post-graduate trainees to gain some experience in research, not only to assist in carrying out original studies but also to cultivate skills to become accomplished research consumers. This will enable them to be informed about current evidence and enhance their professional practice [1].

However, there have been many obstacles to fulfil this aim. Post-graduate trainees are occupied with their clinical practice, especially in a field like surgery where necessary practical skills must be learned in addition to the core clinical knowledge [1]. Furthermore, partly due to inadequate guidance, many trainees feel discouraged about research altogether or commence impractical or over-ambitious studies often ending up in failures discouraging further attempts in research. Outputs from such attempts are unlikely to contribute to science and are often not disseminated. This is because of too small sample size, lack of novelty, single-centre, lack of proper follow-up and lack generalizability [2]. Furthermore, there is a general lack of formal training in research methodology.

In general, there are several disadvantages related to small scale single centre studies. Underpowered studies with a small sample size and broad confidence intervals result in findings that contribute minimally to science and unlikely to change clinical practice [3]. Many such studies failed to get published in peer-reviewed journals. However, there is an increasing trend to conduct scientific work by collaborative networks [4]. Such collaborative networks enable a group of geographically scattered researchers of common interests to communicate and contribute towards a common goal. This is

feasibly achieved through online platforms using modern information technology [5].


Several difficulties about working across geographical distance have been identified. These include issues related to ownership, authorship, funding, intellectual property, trust and communication [1]. The establishment of well organised collaborative networks with well documented and transparent protocols have been helpful to overcome these shortcomings [1]. A functional model for a collaborative research network is shown in figure 1.

In the UK, over the past decade, several trainee-led regional collaborative in general surgery and other specialities have been established [1]. This approach enables to include a sufficiently large sample in a short duration and prevents duplication of data. Moreover, this enables to conduct of multicentre pragmatic studies and allows for greater generalizability in contrast to single centre short term studies [6]. Trainees follow clinical rotation in multiple hospitals nationwide and are in regular contact with each other and therefore, are ideal to implement this model. As trainees become independent practitioners, a culture of surgical research and trials could be distilled in the country's surgical practice [6]. So far, several surgical research collaborative networks have been initiated in the UK with considerable success with large scale trainee-driven cohort studies and clinical trials [6].

There is increasing evidence that research experiences of trainee doctors have long term benefits in their subsequent careers and may also enhance the opportunities for overseas training [7]. This may positively influence lifelong academic inquisitiveness and contributions to teaching, ultimately improving patient care. Due to the above reasons, a research forum led by trainees with the support and guidance of experienced researchers will be useful. Such an initiative should allow all trainees within a region or country to team up irrespective of the geographical location, academic schedule and long term academic interest. In conclusion, a trainer-led collaborative platform may be an effective model to enhance and promote high-quality surgical research in Sri Lanka.

Correspondence: Umesh Jayarajah

E-mail: umeshe.jaya@gmail.com

 <https://orcid.org/0000-0002-0398-5197>

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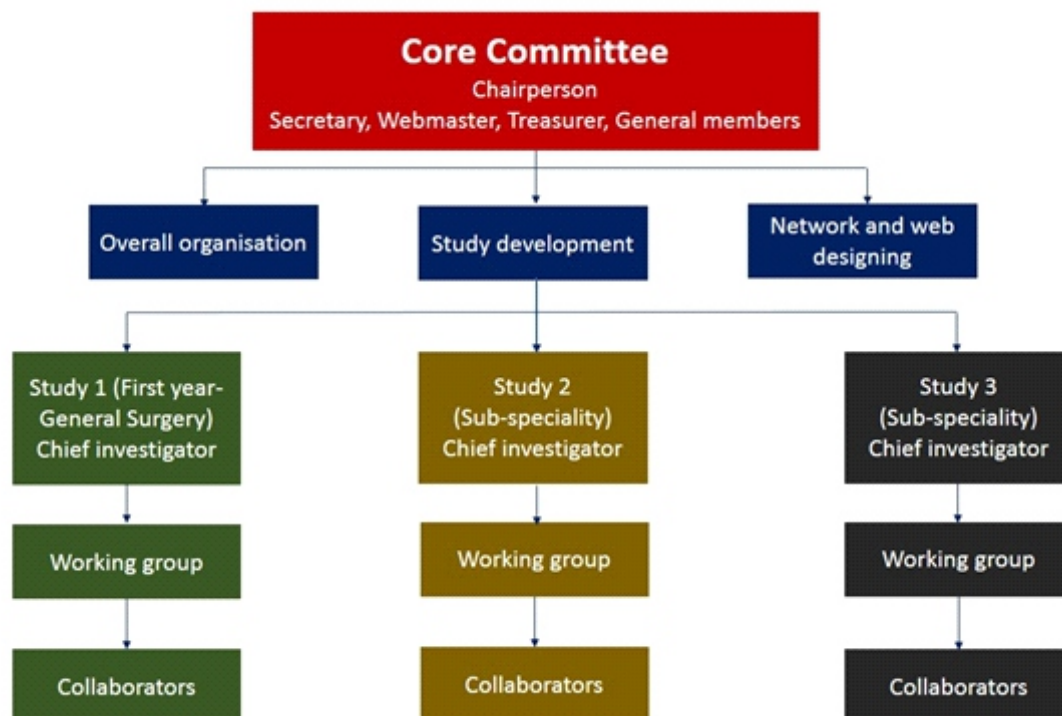


Figure 1. Functional model for a collaborative research network

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Favourable anatomical variation for an extended hepatectomy with portal vein resection in a hilar cholangiocarcinoma involving second order ducts

Prabath Kumarasinghe¹, Hasith Fernando¹, Chathurika Sagara², Aloka Pathirana³

¹National Hospital of Sri Lanka

²Colombo South Teaching Hospital

³Faculty of Medical Sciences, University of Sri Jayewardenepura

Keywords: Hilar cholangiocarcinoma; portal vein; hepatic artery

Introduction

A fifty-seven-year-old female presented with recent onset painless obstructive jaundice. She had no other comorbidities. Her total bilirubin was elevated with a predominant direct fraction (Total bilirubin-330mmol/l, Direct.bilirubin-165.66 mmol/l). CECT findings were consistent with hilar cholangiocarcinoma (Bismuth-Corlette type 3A) without distant metastasis. An external biliary drain was placed in the right hepatic duct, to relieve the obstruction. The percutaneous transhepatic cholangiogram confirmed the involvement of the hepatic duct confluence. CT-angiogram revealed a replaced right hepatic artery originating from the superior mesenteric artery

Procedure

A modified Makuuchi incision was made to open into the peritoneal cavity. The peritoneal survey confirmed a localised disease. The liver showed extensive cholestatic changes. Hilar dissection was performed and the right hepatic artery arising from the superior mesenteric artery was dissected away from the tumour. Tumour infiltration was noted at the portal vein confluence. The right hepatic duct (RHD) was involved near the confluence and tumour extension noted in the left hepatic duct (LHD). Left hemi-liver with caudate lobe was mobilized off the inferior vena cava. Parenchymal transection was carried out along the inter-sectoral line (between the right anterior and posterior sector).

Anterior sector vessels were divided between ligatures and inflow to the posterior sector was carefully preserved. The right posterior sectoral hepatic duct was divided from the lesion with a margin. Imprint cytology was done to confirm negative margins. Parenchymal transection was completed using CUSA®. The left hepatic artery was divided close to the gastroduodenal artery between ligatures. The right portal vein (RPV) was slung distal to the tumour and the main portal vein

(MPV) slung below the confluence and vascular clamps applied.

The portal vein was divided at MPV and RPV well away from the tumour. Left and middle hepatic veins were divided by vascular staplers and an extended Left Hepatectomy specimen was removed en-bloc with the common bile duct, right anterior and left hepatic duct and the portal vein segment with perihilar lymphatics. MPV was anastomosed to the distal RPV with 5.0 polypropylene. Limited mobilization of the right lobe of the liver and plication of the right diaphragm was done to relieve the tension at the PV anastomosis.

Roux-en-Y hepaticojejunostomy was done to the right posterior sectoral bile duct. Postoperative doppler confirmed good doppler flow of the RHA and RPV. The patient had an uneventful recovery and was referred for adjuvant chemotherapy. Histology confirmed a moderately differentiated cholangiocarcinoma with a negative RHD margin and PV resection margin.


Discussion

Hilar cholangiocarcinoma has a dismal prognosis without complete surgical resection (with negative resection margins) [1, 2, and 3]. En-bloc resection of the tumour with PV and perihilar lymphatics provides improved survival in carefully selected patients with HCCA. Routine resection of the PV when there is evidence of tumour abutment may minimize the tumour dissemination during dissection [4]. Especially right-sided tumours frequently invade the RHA due to its close relationship to the biliary confluence [5]. In instances where RHA originates from SMA, a more lateral course of the artery makes it less likely to be involved by the tumour.

Given the lack of an alternative curative method for hilar cholangiocarcinoma, aggressive resection with involved portal vein provides the greatest survival benefit and it can be performed safely as in our given patient.

Correspondence: Prabath Kumarasinghe

E-mail: ranganaksinghe14@gmail.com

 <https://orcid.org/0000-0002-5078-0944>

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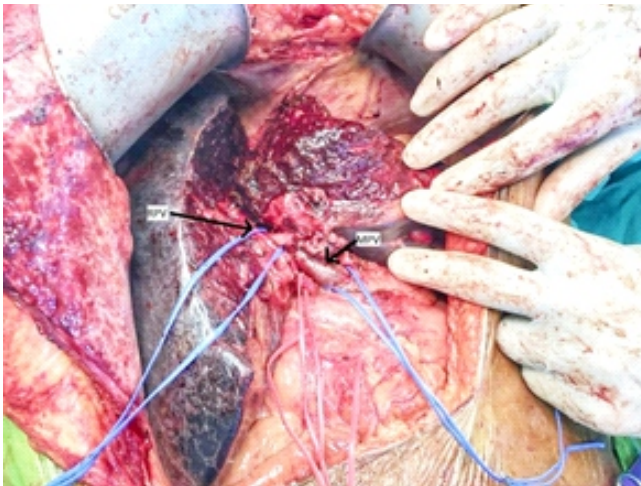


Figure 1. Liver parenchyma split along the intersectional line of right anterior and posterior sectors, portal vein confluence infiltrated by the tumour.

RPV- Right portal vein

MPV- Main portal Vein network



Figure 2. Preserved right posterior sector of the liver with intact inflow structures

HD-RP - Hepatic duct right posterior

HA-RP- Hepatic artery right posterior sector

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Isolated jejunal loop hepaticoduodenostomy following excision of type VI-A choledochal cyst

A. D Dharmapala¹, B.K Dassananyake¹, P. G Athanospoulos², K.B Galketiya¹, M. Malago²

¹ Department of Surgery, Faculty of Medicine, University of Peradeniya, Sri Lanka

² Academic Department of Surgery, University College London/Royal Free NHS trust, Hampstead, London

Keywords: Hepaticoduodenostomy; choledochal cyst; MRCP; jejunal loop

Introduction

Choledochal cyst is a congenital dilatation of the intra hepatic or extra hepatic bile ducts or both. This is classified by Todani classification, which was modified by Alfonso. Depending on the involvement of the biliary tree and the morphological appearance, it is classified into 5 types [1, 2] (Figure 1). Type I consists of a solitary extrahepatic cyst, type II is an extrahepatic supraduodenal diverticulum, type III is an intraduodenal cyst (choledochocoele), type IV consists of both extrahepatic and intrahepatic cysts; and type V consists of multiple intrahepatic cysts (Caroli's disease).

The etiology for the development of this dilatation is still not clearly established but the abnormalous pancreatico biliary junction (APBJ) is so far the most accepted explanation [3]. Due to the APBJ the pancreatic juice is refluxed back into the bile, weakening the wall and resulting in a dilatation of the ducts [4].

The dilated bile ducts allow stasis of bile causing a chronic irritation leading to dysplastic changes in the mucosa and causing cholangio carcinoma [5].

Therefore, the treatment of these cysts consists of complete excision of the cyst and reconstruction with a roux and y hepatico jejunostomy. The simple drainage procedure without excising the cyst will not eliminate the risk of malignancy in these group of patients [6,7].

There are various forms of reconstruction techniques and this is a case report where an isolated jejunal graft with its vascular pedicle is used to reconstruct the bile duct.

Case presentation

A 21-year-old female presented with repeated attacks of cholangitis and acute pancreatitis. The investigations with an MRCP scan (Figure 2) showed a type IVA choledochal cyst as

the aetiological factor Her cholangitic attacks and pancreatitis were managed successfully and she was scheduled for an elective choledochal cyst excision. The surgery was performed with an upper midline incision.


A careful adhesiolysis and a complete dissection of the cyst were done. It demonstrated that the right anterior, right posterior, left, segment 4 and caudate ducts opening up separately to the hepatic hilum thus confirming the preoperative MRCP scan findings. The distal end was cannulated and an operative cholangiogram was performed to confirm the complete dissection of the cyst right down to the ampulla including the intrapancreatic portion of the common bile duct (Figure 3). Once the extension of the cyst delineated and satisfied with the dissection, the cyst was completely excised with the gallbladder.

A 15cm long-isolated jejunal loop with its vascular arcade taken as the conduit to perform the hepaticoduodenostomy. The divided 15cm graft was brought up through the transverse mesocolon into the supra colic compartment. The proximal end was then sutured to the opened proximal end of the hepatic duct at the porta hepatis in an end-to-side fashion with a continuous 3/0 Poly dioxone stitch. The distal end of the jejunal graft was anastomosed to the convex or lateral aspect of the second part of the duodenum (D2) similarly with 3/0 polydioxone. The graft vascularity was good and there was no bile leak from the anastomoses. The proximal and distal ends of the jejunum were anastomosed with a 3/0 polydioxanone stitch in a double-layered fashion to keep the continuity of the small intestine. The abdomen was closed by routine closure leaving a size FR 24 drain in the right subhepatic space. A single dose of teicoplanin, gentamycin and metronidazole was given as prophylactic antibiotics.

The patient had an uneventful recovery. She had a follow-up MRCP 6 months and 1 year later which did not show any evidence of anastomotic strictures. She is asymptomatic two years following surgery. The histology of the cyst wall showed chronic inflammatory changes only and there was no evidence of metaplasia or malignancy

Correspondence: Arinda Dharmapala

E-mail: arindad@yahoo.com

 <https://orcid.org/0000-0002-7414-9241>

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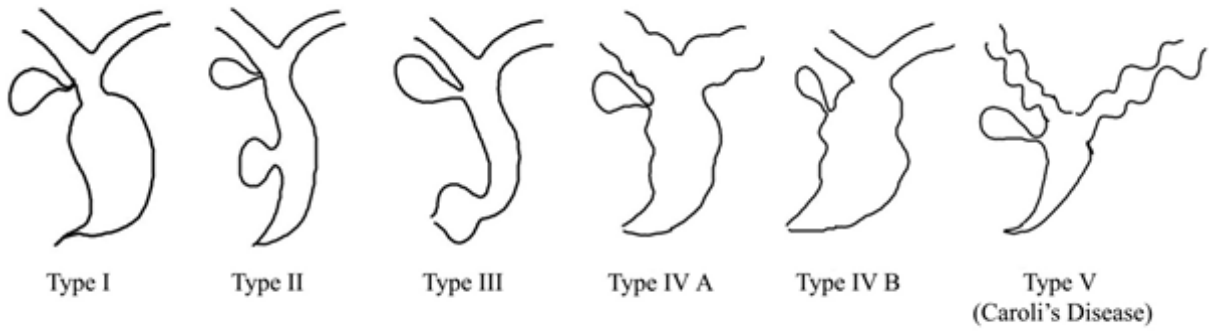


Figure1. Appearance of 5 types and the subtypes of biliary tree depending on the involvement and the morphological appearance

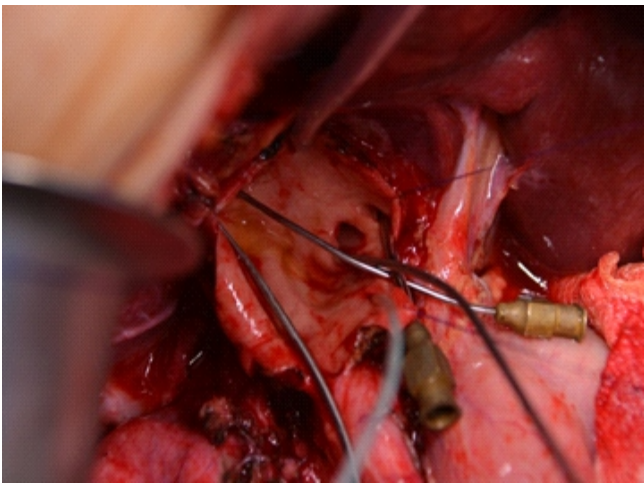


Figure 2. Demonstrate the hilum with the opening of the ducts

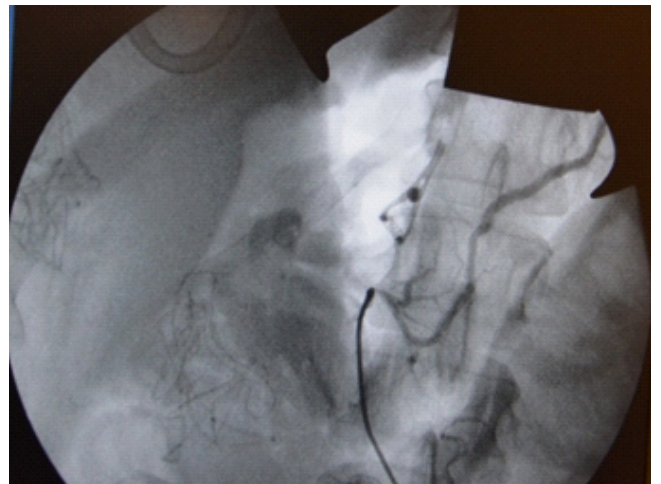


Figure 3. The intra operative cholangiogram demonstrating the distal end of the bileduct and the cannula tip lies just at the junction of the CBD to the PD. The contrast can be seeing going in to the PD.

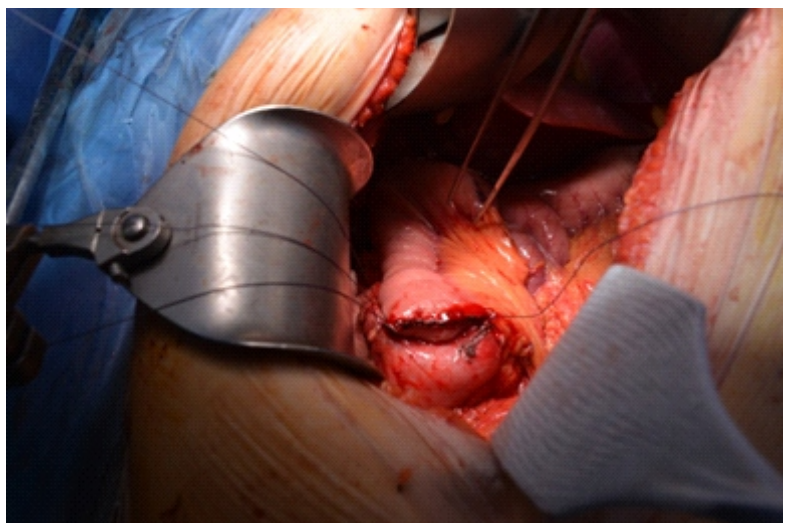
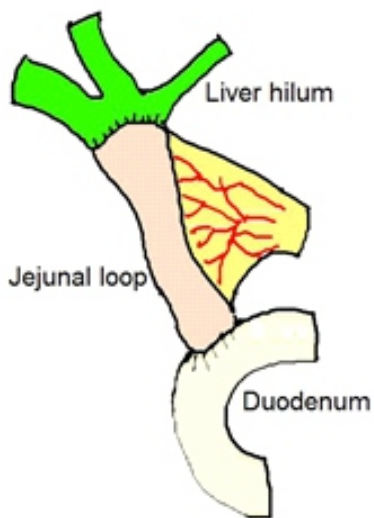


Figure1. The hepatico jejunostomy and the preparation for the hepatico duodenostomy

Discussion

The management of type IV-A choledochal cyst involves the complete excision of all the dilated ducts as much as possible. Some advocate dissection into the parenchyma to remove all dilated intrahepatic ducts or remove the segment of the liver which is involved. Since it was bilobar disease we were unable to proceed further. The further dissection into the liver would have done more harm than a benefit.

The wide opening of the hilum and creating a wider anastomosis is essential in preventing anastomotic strictures, which is a major concern in hepaticojejunostomy. This is also a key factor in preventing bile stasis and recurrent cholangitis. In this patient also we were able to create a wider anastomosis and it demonstrated that after a follow up of two years, that there is good drainage of bile without any stasis or cholangitis. The hepaticoduodenostomy which is commonly done in the paediatric group has shown some increased risk of cholangitis and has gone out of favour. This is usually direct anastomosis of the duodenum into the liver hilum. But the chances are minimal for translocation of bacteria when there is an interposition graft and the possibility of recurrent cholangitis is very rare [9].

Hepaticoduodenostomy is more physiological and this gives easy endoscopic access in follow up of these patients. Stricture formation is one of the commonest and difficult complications to manage. Endoscopic access is advantageous in this situation as a therapeutic option. The endoscopic access gives an additional advantage of a more detailed inspection with direct visualization by cholangioscopic usage.

Other advantage of endoscopic surveillance is that biopsies can be taken from suspicious areas. These factors favour the jejunal interposition hepatico duodenostomy than a roux -en -Y reconstruction.

The adequate length of the interposition graft is also important in preventing ascending cholangitis. The duodenogastric reflux should be minimal in the interposition hepatico duodenostomy as there is minimal disruption of the pylorus and the duodenum [10].

It is demonstrated that jejunal interposition hepatico-duodenostomy will be a more physiological reconstruction following excision of choledochal cyst than other commonly used reconstruction methods. Moreover, this gives the additional benefit of having endoscopic access for close monitoring as well as in managing post-operative complications. Therefore, this can be recommended as a safe procedure in managing patients with choledochal cysts who require intense and long term follow up.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- Isolated jejunal loop hepaticoduodenostomy following excision of type VI-A choledochal cyst is a more physiological reconstruction.
- The ability for endoscopic access is the main advantage in dealing with complications and long term follow up.
- It is technically not difficult to perform

Primary squamous cell cancer of the liver- a rare complex cystic liver lesion

Kachchakadugen Jude Dilshan Fernando¹, Hiroshi Jayathilake¹, Buddhika Uragoda², Suchintha Tillakerathne¹, Rohan Chaminda Siriwardana¹
¹Faculty of medicine, University of Kelaniya, Sri Lanka
²Colombo north teaching hospital, Sri Lanka

Keywords: Squamous cell; cancer of the liver; complex cyst

Introduction

Cystic liver lesions are commonly diagnosed due to the widespread use of ultrasound scans. A large majority of these are benign. Occasionally, patients present with doubtful radiological features, which require further evaluation and intervention. This case describes an extremely rare case of cystic neoplasm of the liver.

Case presentation

A 49-year-old male underwent an ultrasound scan for right-sided abdominal pain and revealed a large cystic lesion in the right lobe of the liver. Further imaging with a triple-phase CT scan revealed a complex cyst. Initial diagnosis of biliary cystadenoma was considered. As apart of the workup, a diagnostic aspiration was done. Tumour markers and cytological evaluation were normal. Considering the radiological appearance of a complex cyst, the patient was offered the right hepatectomy. During laparotomy, multiple small peritoneal nodules were noted in the right upper abdomen. Imprint cytology from the lesions revealed malignant cells. Surgery was abandoned after taking a biopsy from the cyst and deposits. Subsequent histology revealed a moderately differentiated invasive squamous cell carcinoma (SCC) of the liver. Later, the patient was further evaluated to exclude possible primary focus, which became eventually negative.

Discussion

Primary SCC of the liver is extremely rare with less than 50 reported cases globally [1]. Skin, head and neck, respiratory tract, oesophagus, cervix, and rectum are common. Though the exact origin is unclear, a common hypothesis is inflammation of a longstanding cyst leading to squamous metaplasia and subsequent SCC [2,3]. In a few rare cases, SCC was attributed to hepatic teratomas and hepatolithiasis [4].



Figure 1. Contrast enhanced computed tomography showing complex liver cyst.

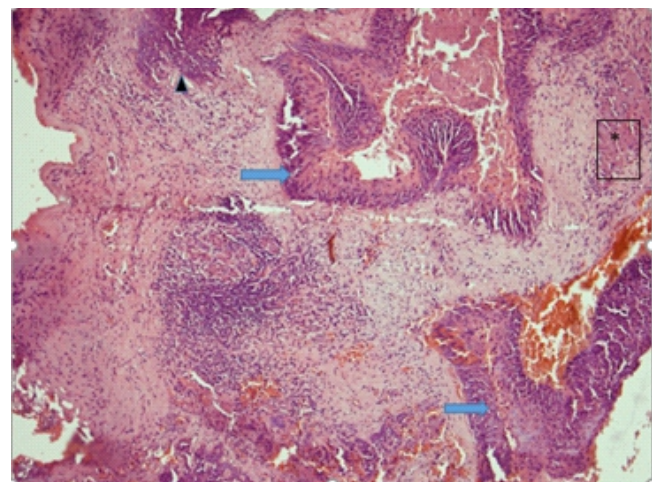



Figure 1. Liver tissue (*) with a cyst wall lined by dysplastic stratified squamous epithelium(--->). The discontinuous basement membrane in focal areas raises the possibility of invasion (^).

Localized disease to the liver is managed by radical resection. Alcohol ablation and transcatheter arterial chemoe-mbolization were other treatment options offered in literature [5]. However primary SCC of the liver has aggressive behaviour and a poor prognosis. Reported overall survival is less than one year [3, 4].

Correspondence: U. A Buddhika

E-mail: buddhikauragoda@gmail.com

 <https://orcid.org/0000-0002-9118-6722>

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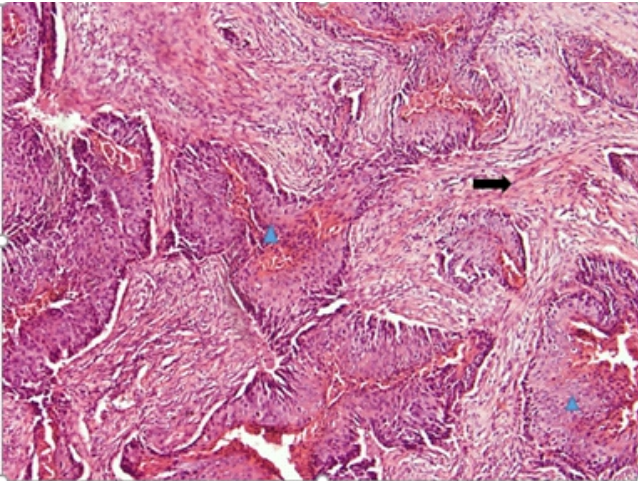


Figure 3. Figure 2: Peritoneal biopsy showing an Infiltrating tumor composed of anastomosing cords, nests, and trabeculae (^). The constituent squamoid cells bear moderately pleomorphic nuclei with coarse chromatin and eosinophilic cytoplasm. The stroma is desmoplastic (-->)

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- Primary squamous cell cancer of the liver is very rare.
- It can arise from a pre existing cyst.
- Generally has a poor prognosis.

Distal pancreatectomy with coeliac axis resection (Appleby procedure)

Prabath Kumarasinghe¹, Ruwan Dissanayaka¹, Buddika Uragoda², Dulani Benaragama³,
Deepaka Weerasekara³

¹National Hospital of Sri Lanka

²Professorial unit, Colombo North Teaching Hospital

³Faculty of Medical Sciences, University of Sri Jayewardenepura

Keywords: Coeliac axis; distal pancreatectomy; aorta; complications; liver

Introduction

Pancreatic neck and body cancer are frequently diagnosed at a locally advanced stage. According to current recommendations, involvement of superior mesenteric artery (SMA) or coeliac axis (CA) is no longer a contraindication for surgery [1]. In a selected subset of patients' coeliac axis resection with distal pancreatectomy (DP-CAR) can be done safely without vascular reconstruction.

Case presentation

A sixty-four-year-old woman presented with persistent epigastric pain with significant loss of appetite and loss of weight of 6 kg in 4 months duration. On further evaluation with MDCT pancreatic neck and body tumour was detected with tumour encasement (>180 degrees) of the coeliac axis. She had no evidence of distant metastasis on cross-sectional imaging and CT mesenteric angiography confirmed patent pancreatoduodenal vascular arcade between a gastroduodenal artery (GDA) and SMA. She was planned for distal pancreatectomy with a coeliac axis resection (DP-CAR).

At the peritoneal survey, there were no distant metastases. There was a solid tumour involving the body and tail of the pancreas with the involvement of the coeliac axis (>180 degrees) and its branches. Common hepatic artery (CHA) was involved by the tumour up to the GDA junction. Clamp placed at CHA and liver doppler was done to confirm retrograde hepatic perfusion.

The pancreas was tunnelled anterior to the portal vein. SMA was explored and it was uninvolved. Pancreas transected at the neck away from the tumour preserving the GDA. CHA was transected 1mm away from the GDA junction and closed the distal end with 5.0 prolene. The left gastric artery was divided close to the stomach. Further dissection was carried along the anterior surface of SMA to reach the anterior surface of the



Figure 1. Post DP-CAR


aorta. Aorta was cleared on the sides to place an aortic clamp. CA was excised after side clamping the aorta and the defect was sutured with 3.0 prolene. A distal pancreatectomy with splenectomy was performed. The posterior resection margin was cleared to achieve complete exposure of the left renal vein. The proximal pancreatic margin was closed with 5.0 prolene. The drain was kept at the pancreatic transection site.

The patient had an uneventful recovery. On day 0 serum lactate was recorded highest 3.5(mmol/L) and by day1 it was reduced to 1.5(mmol/L) while the recorded highest AST was on Day 2 (192U/L). An ultrasound scan was done in 2 weeks reconfirmed retrograde hepatic perfusion without any collections in the pancreatic bed.

Histology confirmed a moderately differentiated ductal adenocarcinoma on a background of chronic pancreatitis with negative resection margins at the root of CA and distal CHA. There were perineural invasion and infiltration of coeliac ganglions by the tumour. Four lymph nodes (peripancreatic) out of eighteen (Peripancreatic 7, perisplenic 11) were positive for tumour deposits. Tumour staging was pT4N2. The patient was referred for adjuvant chemotherapy.

Correspondence: Prabath Kumarasinghe

E-mail: ranganaksinghe14@gmail.com

 <https://orcid.org/0000-0002-5078-0944>

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Discussion

Appleby procedure was performed initially in 1953 for a locally advanced gastric cancer [2]. Since then it gained popularity and has been adopted to treat locally advanced pancreatic cancer. Careful patient selection is essential to delineate patients who may benefit from this extensive procedure. A crucial aspect of this procedure is to re-establish the blood supply to the liver after coeliac axis resection. There is a constantly existent pancreatoduodenal vascular arcade from the Superior mesenteric artery (SMA) connecting to the Gastroduodenal artery (GDA). If this arcade is patent CA resection can be done without vascular reconstruction.

Detailed imaging including MDCT with CA and SMA angiography is essential to delineate the local extent of the lesion and to assess the collaterals. The tumour must be confined to the pancreatic neck and body and the pancreatic head should be spared. Extension of the tumour must be confined to CA without the involvement of the aorta. Gastroduodenal artery, proper hepatic artery or SMA should not be involved by the tumour.

DP-CAR has mortality around 3% even though it has high morbidity (49%) [3, 4]. Common postoperative complications are pancreatic fistula, delayed gastric emptying and chylous ascites. Hepatic infarction is the most dreaded complication after DP-CAR.

In carefully selected patients DP-CAR offers a survival benefit over unresected locally advanced pancreatic ductal adenocarcinoma involving the coeliac axis [5]. Median overall survival after DP-CAR is 15-17 months and 1-year survival is 60-87%.

Conclusion

DP CAR is a complex surgical procedure for patients with locally advanced pancreatic neck and body carcinoma involving the coeliac axis. Favourable outcomes can be achieved with careful selection of patients before the procedure. A specially detailed evaluation of vascular anatomy and collateral circulation is essential to overcome serious complications after this procedure.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- Surgical resection with curative intent is possible in locally advanced carcinoma of the pancreas.
- Detailed radiological assessment with coeliac axis and superior mesenteric artery angiography is essential in planning DP-CAR.
- Common complications of DP-CAR includes pancreatic fistula, gastric ischemia and rarely hepatic necrosis.

Hybrid endo-laparoscopic management of sigmoid colon perforation due to an accidentally ingested denture

S. H. R. Sanjeewa¹, V. Sanjeev¹, G. M. D. Kariyawasam¹, M. A. C. Lakmal¹, G. P. U. P. de Silva¹, B. D. Gamage²

¹University Surgical Unit, Colombo South Teaching Hospital

Keywords: Hybrid; endoscopy; laparoscopy; ingested denture; bowel perforation

Introduction

Denture ingestion is one of the commonest ingested foreign bodies we encounter in surgical casualty. The concern is that most dentures are radiolucent and difficult to identify on conventional imaging which may delay diagnosis. Here we present a case of a 46-year-old female who was admitted with clinical and radiological signs of bowel perforation. X-ray supine abdomen and the non-contrast CT imaging failed to provide a conclusive diagnosis. Diagnostic laparoscopy revealed a mid-sigmoid perforation with partial protrusion of the denture. Colonoscopic retrieval of the denture and intracorporeal suturing of the sigmoid perforation were performed. The patient had an uneventful recovery. We suggest minimal access interventions are both diagnostic and therapeutic in the management of complications of ingested foreign bodies.

Case presentation

A 46-year-old female presented with lower abdominal pain for 4 hours duration. She recalled swallowing her loose denture while taking pills 3 days before the admission. She was tachycardic. Abdominal examination revealed tenderness over the lower abdomen. Erect chest X-ray showed air under the diaphragm. Though the NCCT abdomen confirmed pneumoperitoneum it couldn't conclusively identify the foreign body.

The decision was made to proceed with diagnostic laparoscopy. The pointed end of the denture was seen through a perforation of the mid sigmoid colon [Figure 1]. A moderate amount of purulent fluid was present in the peritoneal cavity. No gross faecal contamination was seen. The denture was carefully pushed back into the sigmoid colon and the decision was taken to attempt endoscopic retrieval of the denture and laparoscopic repair of the perforation. The sigmoid colon was clamped just distal to the perforation with a non-

traumatic intestinal grasper to avoid unnecessary bowel distension during colonoscopy. The denture was grasped with snare forceps [Boston Scientific Microvasive®, rotatable snare forceps] and withdrawn carefully under direct vision without damaging the colonic wall [Figure 2]. Perforation was repaired intracorporeally with 3/0 polydioxanone [PDS] interrupted sutures. A thorough washout of the peritoneal cavity was done with normal saline.

The patient had an uneventful recovery and discharged on the third postoperative day.

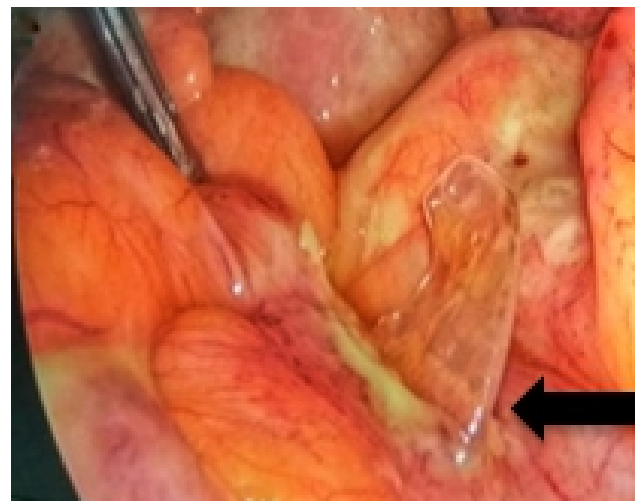


Figure 1. Part of the denture is seen through the perforation of the sigmoid colon

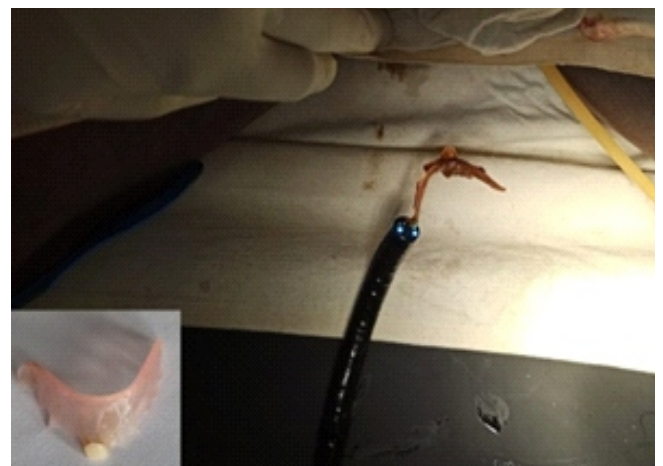


Figure 2. Endoscopic retrieval of the denture

Correspondence: Chamila Lakmal

E-mail: lakmalmac@gmail.com

<https://orcid.org/0000-0003-3867-7861>

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Discussion

Ingestion of foreign bodies is a common presentation to surgical casualty. Dentures are among the commonest such ingested items [1]. Studies estimated that the majority [80-90%] of these will pass through the digestive tract without complications. However, necrosis, perforation, migration to close-by organs, haemorrhage and bowel obstruction have been reported. Gastrointestinal perforation is a rare complication, occurring in less than 1% of the cases of foreign body ingestion [2]. Perforation frequently occurs at sites of acute angulation and narrowing. Ileo-caecal junction and sigmoid colon are the commonest sites where perforation occurs.

Computed Topography [CT] is considered the best method to accurately locate the site of foreign bodies [2]. In the event of perforation, CT has shown the perforation and the cause of perforation with 86 % accuracy [2] Most of the dentures are made from polymethylmethacrylate [PMMA] which is radiolucent. Therefore it is difficult to visualize on conventional imaging [3]. In our case non-contrast, CT imaging failed to localize the denture conclusively.

Management options following ingestion of dentures are close observation, endoscopic extraction and surgery. When there are no complications at presentation, the denture is small in size, its shape does not risk causing injury to the bowel wall [e.g. not pointed; no sharp edges] and when the item is distal to the ligament of Trietz at presentation, observation can be considered [4].

Approximately 1-14% of ingested foreign bodies will necessitate surgical intervention. Indications for surgery are failed endoscopic retrieval and the presence of complications [4]. Our patient required surgery as she presented with evidence of visceral perforation.

Complicated foreign bodies particularly with bowel perforation require surgery. Most perforations need open surgery. Combined laparoscopy and trans-anal approach for

retrieval of a foreign body in the distal colon has been reported [5]. The foreign body has been pushed down from the distal colon into the rectum and retrieved per anally using an anoscope.

Not many cases of hybrid endo-laparoscopic management of foreign bodies with visceral perforation have been reported. It avoids a major laparotomy, gives early recovery with less wound-related complications and good cosmesis as well. As we demonstrated, this method is technically feasible and safe.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- Approximately 1-14% of ingested foreign bodies will necessitate surgical intervention.
- Laparoscopy has a diagnostic and therapeutic value in management of ingested foreign bodies with complications.
- Hybrid endo-laparoscopic management of foreign bodies with visceral perforation avoids a major laparotomy, gives early recovery with less wound-related complications and good cosmesis, and is technically feasible and safe.

A case of an accidental ingestion of a toothbrush

G. P. U. P. de Silva, R. M. S. S. B. Rathnayake, M.S. E. Karunadasa
Surgical Unit, Base hospital Mahiyangana

Keywords: Upper gastrointestinal; foreign body; toothbrush

Introduction

Approximately 20% of upper gastrointestinal foreign bodies are reported among adults. The ingestion could be accidental or intentional to achieve secondary gain. Accidental ingestions of non-food objects are rare and reported in patients with neurological, psychiatric illnesses or alcohol intoxication [1, 2].

Approximately 80% of upper gastrointestinal foreign bodies pass without any intervention. However, stiff objects longer than 5-10cm are less likely to pass through the lower oesophageal sphincter and have the tendency to impact one of the physiological narrowings of the oesophagus [3, 5]. Foreign bodies impacted in the oesophagus for more than 24 hours have the risk of complications including pressure necrosis, perforation, mediastinitis, retropharyngeal abscess and aspiration. Therefore an urgent endoscopic intervention is required.

Case Presentation

We present a case of a 67 years old man who had an accidental ingestion of a toothbrush while brushing teeth. He admitted to the emergency treatment unit of Base Hospital Mahiyangana 1 hour after the incident. The patient could not withstand the strong involuntary drag applied to the toothbrush while brushing the posterior part of the tongue. He complained of retrosternal chest pain, absolute dysphagia and spoke with difficulty. He was not inebriated and denied a background history of psychiatric or neurological illness.

He looked anxious and there was drooling of saliva. His vital signs were stable except for tachycardia. His neck extension was restricted. There was no oedema or crepitus noted at the neck or chest region. Auscultation of the lungs did not reveal any added sounds. The chest radiograph showed the head of the toothbrush lying at the level of the left bronchus (Figure 1).

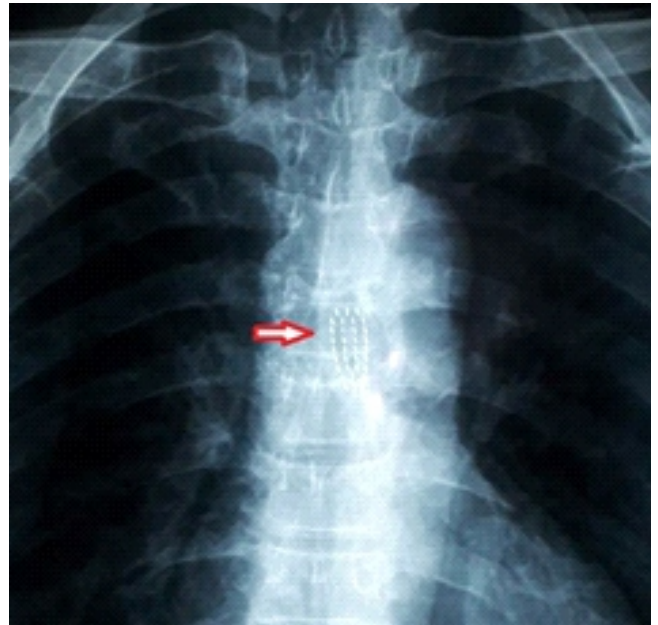


Figure 1. Chest radiograph showing head of the toothbrush

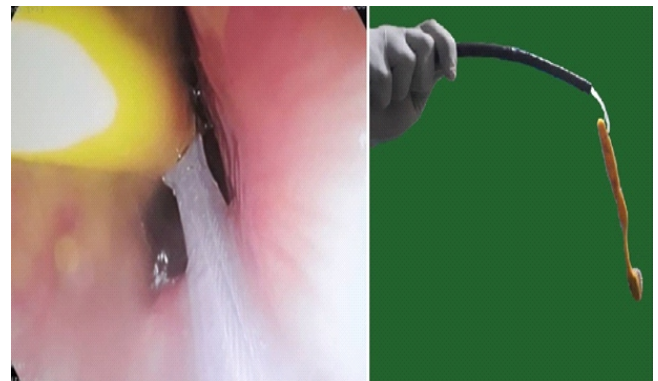


Figure 2. Removal of toothbrush with a snare loop


Emergency upper gastrointestinal endoscopy was carried out under deep sedation. The handle of the brush was seen just distal to the upper oesophageal sphincter. It was removed using a snare loop successfully (Figure 2). The recovery was uneventful and the patient has been discharged on the second post-procedure day.

Discussion

Upper gastrointestinal foreign bodies are reported commonly among children between 6 months to 3 years. Among the

Correspondence: G P U P de Silva

E-mail: upulonline@gmail.com

 <https://orcid.org/0000-0003-2508-3765>

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adults, fish bones and dentures are the commonly reported foreign bodies [2]. However, accidental ingestion of non-food objects in adults are rare and precipitated by neurological, psychiatric illnesses or alcohol intoxication [1].

Approximately 80-90% out of upper gastrointestinal foreign bodies pass without any intervention, 10-20% require endoscopic removal and about 1% necessitate surgical removal. Impaction generally occurs at physiological narrowing and angulations. There are 4 narrowings at the oesophagus namely, upper oesophageal sphincter, level of the aortic arch, level of the left main bronchus (seen in this patient), and lower oesophageal sphincter. Pylorus, ileocecal valve and anus are the other physiological narrowing of the gastrointestinal tract. The duodenal sweep is the typical site for physiological angulation [3]. Foreign bodies longer than 5-10cm are less likely to pass through the lower oesophageal sphincter and difficult to remove through the upper oesophageal sphincter [5].

Foreign bodies impacted in the oesophagus have the risk of complications including pressure necrosis, perforation, mediastinitis, retropharyngeal abscess and aspiration. The risk of developing a complication is increased by 14.1 times when the foreign body is impacted in the oesophagus for more than 24 hours. Also, the feasibility of successful removal is reduced with the delay [4].

Therefore therapeutic endoscopy should be arranged within 24 hours. However, the presence of features of complete oesophageal obstruction denoted by the inability to swallow saliva as in our patient warrants emergency endoscopic removal at least within 6 hours (preferably within 2 hours) since the higher risk for aspiration and aforementioned complications [2]. Our patient had an uneventful, early recovery and had been discharged on the following day, as we were able to perform the therapeutic endoscopy within few hours of the admission.

Radiological evaluation in suspected foreign body ingestion includes the x-rays of the neck, chest and abdomen to determine the size, site of impaction and configuration. This will further detect the presence of complications including pneumomediastinum, pneumoperitoneum, subcutaneous emphysema and aspiration [2]. Even though plastic objects are not regularly identified on X-rays due to their radiolucent nature, we were able to identify the head of the toothbrush on the X-ray chest posteroanterior view (Figure 1). Lateral view of chest X-ray aids to locate the position of radio-opaque foreign body and to identify the presence of extraluminal air suggestive of oesophageal perforation [3].

Airway protection was a major concern as the high risk of aspiration due to inadequate fasting and proximal oesophageal location of the foreign body [2]. However, endotracheal intubation was difficult in our patient owing to apprehended position with limited neck extension.

The method of retrieval is decided by the size and configuration of the ingested foreign body. Polypectomy snare or Dormia basket is recommended for the removal of lengthy foreign bodies. The object must be grasped at the end to facilitate successful removal since grasping near the centre would turn the object transversely hindering it from being pulled through the oesophagus. Before performing the therapeutic endoscopy, the most appropriate retrieval method can be determined by practising grasping an object similar to the ingested foreign body using different accessories [2, 5].

Conclusions

Oesophageal impaction of accidentally ingested non-food objects is rare among adults with intact sensorium. The spontaneous passage of long and stiff foreign objects similar to toothbrushes is unlikely and necessitate urgent therapeutic endoscopy to prevent complications including necrosis and perforation of oesophagus, mediastinitis, retropharyngeal abscess and aspiration.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- Accidental ingestion of a toothbrush is rare.
- Therapeutic endoscopy is warranted within 24 hours for oesophageal foreign bodies to prevent sinister complications.
- Emergency endoscopic removal at least within 6 hours (preferably within 2 hours) if the features of complete oesophageal obstruction are present.

True leiomyoma of prostate

Gupta Kartik Chandrakant
Mimsr Medical College, Latur, Maharashtra, India

Keywords: Leiomyoma; prostate; radical prostatectomy; smooth muscle

Introduction

Leiomyoma of prostate occurs in two patterns. The most common presentation is leiomyomatosis associated with benign adenomatous hyperplasia with multiple small nodules. True leiomyoma of the prostate, which is devoid of glandular portion, is another type that is extremely rare [1]. Histopathological examination is the only method by which differentiation between leiomyoma and leiomyosarcoma can be done [2].

We report a case of true prostatic leiomyoma associated with favourable outcome after complete removal [3].

Case presentation

A 68-year-old male presented to casualty with acute urinary retention for which patient was catheterized. Patient had history of chronic retention of urine associated with occasional haematuria. Patient had no associated medical history. Physical examination was normal. On digital rectal exam, a uniformly enlarged prostate gland with smooth surface and elastic consistency noted.

Blood assessment was also normal. Serum PSA was 7.4. Urinalysis revealed E. coli with no other abnormality. USG showed gross prostatomegaly with volume 175 cc and median lobe projecting into urinary bladder. Oval mass arising from postero-inferior region of bladder with size 8 cm & uniformly dense relative to muscle was seen on CT abdomen.

Prostate biopsy was suggestive of benign spindle cell proliferation of prostatic stroma. Patient then underwent open radical prostatectomy. On gross inspection the growth was well confined but devoid of capsule and was nodular in consistency. Cut surface showed a solid, firm, grey white mass with whorled appearance. Microscopy section shows a tumour arranged in fascicles and bundles. Individual cells are elongated, spindle-shaped with hyperchromatic nuclei,

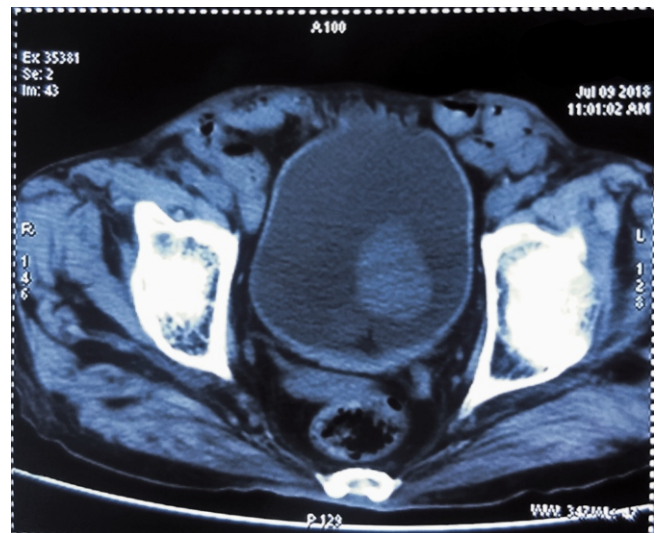


Figure 1. CT abdomen and pelvis showed an 8 cm size, confined oval growth arising postero-inferiorly to bladder

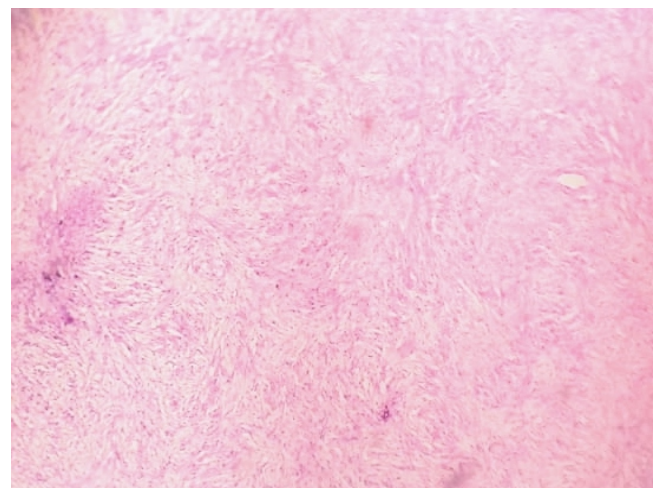



Figure 2. HE staining 10 x spindle-shaped cells arranged in fascicles and bundles. Individual cells are elongated, abundant eosinophilic cytoplasm and absence of normal prostatic glands.

abundant eosinophilic cytoplasm and inconspicuous nucleoli with absence of normal prostatic glands.

A diagnosis of true prostatic leiomyoma was made, confirmed on immunohistochemistry. Post-operative period was uneventful, urinary catheter removed on post-operative day 8. After 12 month of follow-up patient is asymptomatic.

Correspondence: Kartik Chandrakant Gupta
E-mail: drkartik.gupta@yahoo.in

 <https://orcid.org/0000-0002-3462-0959>

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Discussion

Leiomyoma can arise from any organ containing smooth muscles but mostly arise from gastrointestinal and female genital source. It can also be seen in the genitourinary system but is rare [1].

Lebec first reported leiomyoma of prostate in 1876. Following which 64 cases have been reported world-wide [5]. Various theories had been proposed but none firmly established the pathogenesis of prostatic leiomyoma. Most probable cause may be from repeated infections and inflammation, leading to transformation of glandular tissue to smooth muscle [3].

Size and location of leiomyoma determines variety of symptom. Patients presents with complaints similar to benign adenomatous hyperplasia such as acute urinary retention associated with lower urinary tract symptoms and few reported macroscopic hematuria [3, 4, 6].

Ultrasound shows congruent mass with a typical whorled appearance and smooth wall [2]. Computed tomography demonstrate a well circumscribed nodules or mass in the pelvis arising from the prostate with intra-vesical protrusion or compression of the bladder [3]. On MRI, T1-weighted images display intermediate signal strength, while T2-weighted images show medium to intermediate signal intensity which is similar to muscle. Extension of mass and its infiltration into surrounding tissues can also be seen [2].

Spindle shaped smooth muscle cells with ample cytoplasm, combined with absence of nuclear atypia or mitosis on microscopy differentiate leiomyoma with leiomyosarcoma [2, 3]. Atypical nuclei and high mitotic activity indicate malignant pathology which can be ruled out on histological examination [3, 6].

On immunohistochemistry, leiomyoma is positive for myogenic marker such as desmin and smooth muscle actin. Leiomyoma's are negative for c-kit (CD 117) and should be differentiated from GIST (Gastro intestinal stromal tumour) [7]. Complete resection of the tumour is preferred as there is risk for malignant change, particularly when atypical cells are found [2, 3, 5]. Being a benign lesion, complete resection of

leiomyoma is associated with excellent prognosis and very low recurrence rate [2, 4, 6].

Conclusion

True prostatic leiomyoma is a rare, benign lesion which resembles benign hypertrophy of prostate but devoid of glandular tissue. Confirmatory diagnosis can be made with histological examination. Complete removal of tumour benefits with symptom free survival and very low recurrence rate.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- A very rare disorder involving prostate which presents with symptoms similar to benign enlargement of prostate.
- Must be differentiated with leiomyosarcoma using biopsy.
- Complete resection is associated with excellent prognosis.