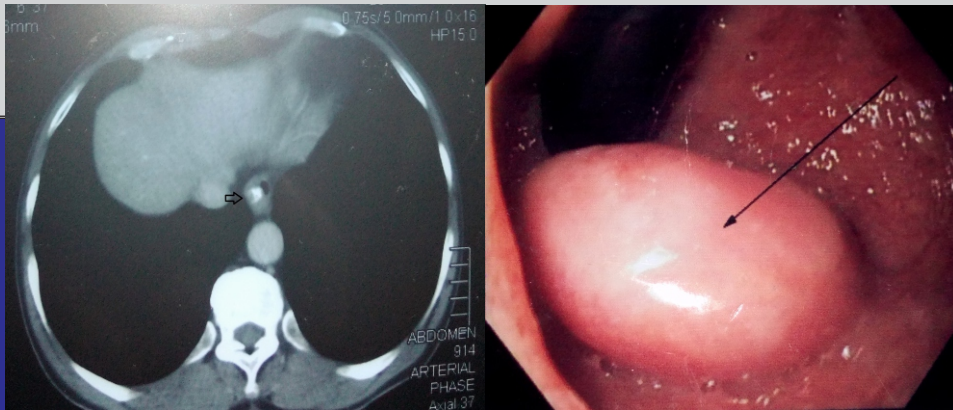




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- Tumour budding - an emerging prognostic factor in colorectal carcinoma
- Percutaneous renal stone surgery: redefining the better technique
- Shifting the paradigm of peri-operative care in colorectal surgery
- Sri Lanka guidelines for the management of hepatic metastases from colorectal cancer
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A centre dedicated for men's health and wellbeing for the first time in Sri Lanka - End your suffering with an effective treatment for Erectile Dysfunction

Lanka Hospitals PLC, a premier health care provider in Sri Lanka, announces its latest addition to the Centres of Excellence- the Male Wellness Centre (MWC) – in a bid to offer services to improve health and wellbeing of men. It's also significant that a fully-fledged wellness centre dedicated solely for men has been established for the first time in Sri Lanka.

The MWC caters to a host of services including Personnel fitness scheduling and programming, Sport health and injury management, Dietary & Nutritional advices, Pre-marital counseling and health screening, Management of premature ejaculation, Management of Erectile dysfunction, Cosmetic surgeries (Bariatric / Ocular / Dental). In addition to the General health screening, patients can obtain screening for Liver, Kidney, Respiratory, Cardiac, Diabetic, Endocrine-Hormonal, Cancer and Sexually Transmitted Diseases in addition to Substances and Alcohol abuses. Furthermore, apart from leading physicians MWC offers the service of competent consultant specialists such as Cardiologist, Endocrinologist, Diabetologist, Venerologist, Urologist, Nephrologist, Oncologist, Surgeon, Vascular Surgeon, Psychiatrist as well as Counsellor.

Erectile Dysfunction (Impotence) is a common health issue suffered by men, defined by the difficulty in achieving and maintaining a penile erection during sexual intercourse. In the Sri Lankan context, the issue is hardly brought into light especially by those who suffer and often show reluctance to seeking proper medical attention. Often, incorrect and misleading advice not only aggravates the issue, but also lead them to face unwanted complications. A special Shock Wave Therapy unit was established within the Male Wellness Centre by the Lanka Hospitals to specifically treat impotence.

The Centre conducts in-depth studies and comprehensive medical analysis to precisely identify the causes for impotence such as Vascular, Psychogenic, Neurological, Hormonal, Structural and others. Being a newer and less invasive way to treat this common sexual challenge shock wave therapy has proven to be effective even when oral medication has failed. Also known as penile extracorporeal low-intensity shockwave therapy, this method involves the use of low intensity acoustic pulse waves that lead to release of factors which promote growth of new blood vessels in the penis. Therapy comprises of a handheld device being angled towards the shaft of the penis. One of the main advantages of this treatment method is that it has no clinically relevant side effects. Each treatment session can last approximately 20 minutes.

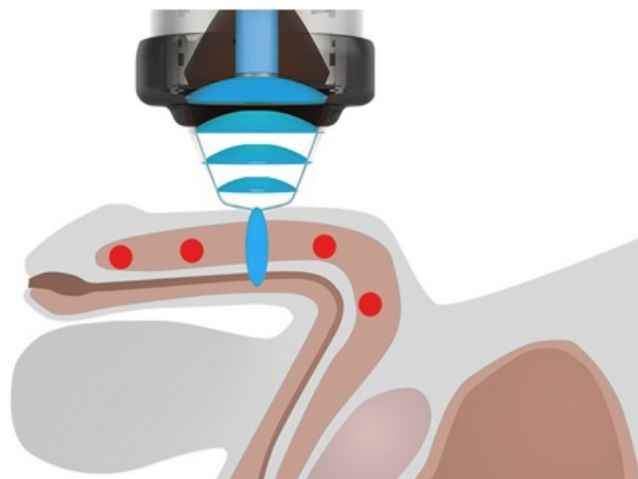


Figure 1. Shock wave therapy

Shock wave treatment is a completely painless way to treat what can be a life altering condition and a regular course of treatment usually comprises of six sessions. The frequency of these session can be tailor made as below and would be decided by the consultant:

- 1) Every day for 6 days
- 2) Every second day over an 11 day period
- 3) Twice a week for 3 weeks

The outcomes include gaining of more frequent erections, more rigid erections, ability to maintain an erection and perform entire act of sexual intercourse and freedom to reduce or omit medication. Therefore the use of a treatment which researchers claim is “really a breakthrough” could be good news for men who have erectile dysfunction.

As a hospital staying abreast with latest medical technology, Lanka Hospitals established Male Wellness Centre in a bid to provide world class health care services to Sri Lankan as well as International patients. Moreover, when catering to health issues and conditions that are highly sensitive and personal, Lanka Hospitals delivers complete confidentiality to its patients with the assistance of its specially trained staff.

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Erectile Dysfunction Shockwave Therapy (SWT)

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Advantages of Penile Shockwave Therapy

This procedure is a pain-free, non-invasive and non-pharmacological procedure that triggers a natural mechanism that solves most ED-related problems. There is lot of evidence to show very satisfactory outcomes of this therapy.

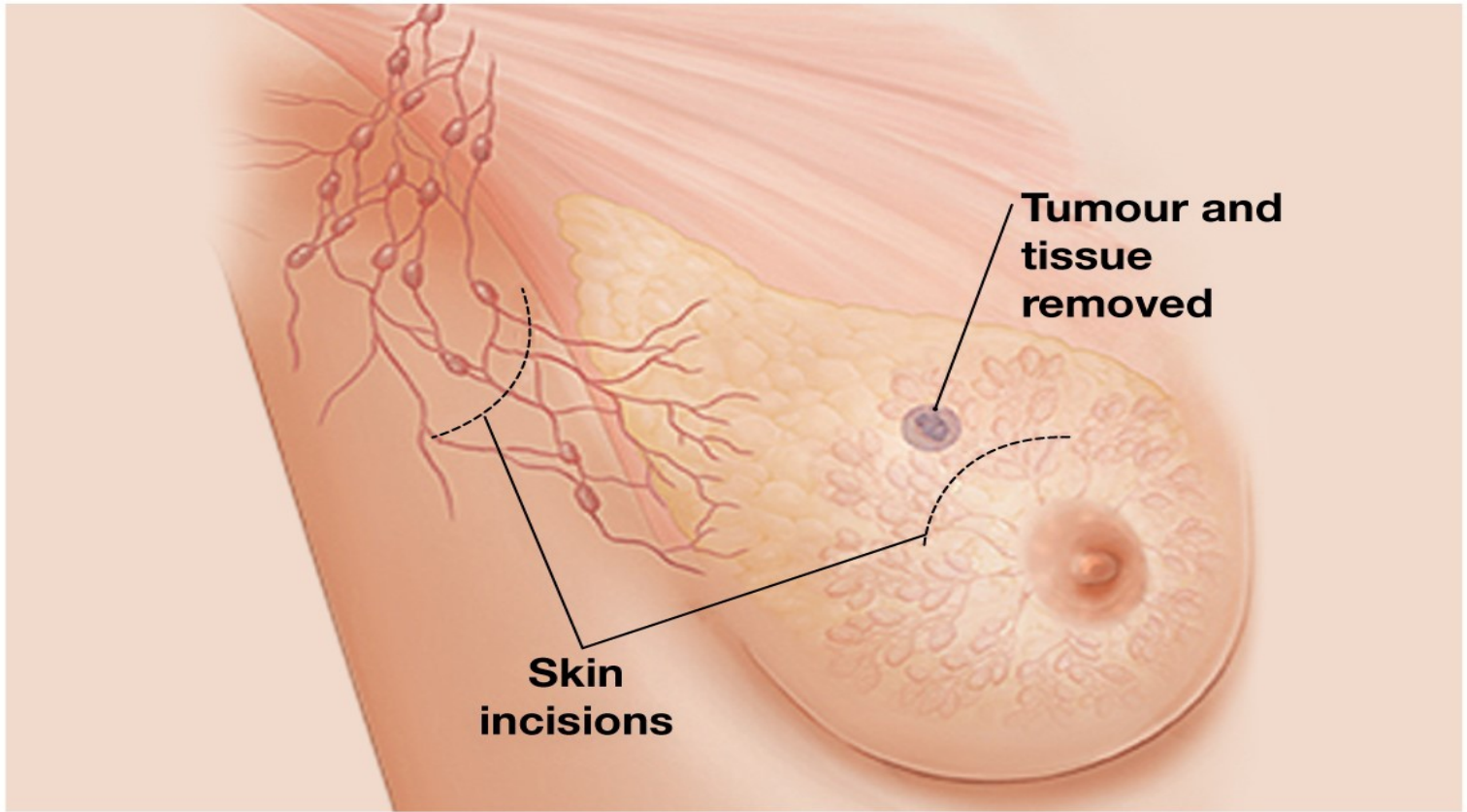
Protocol

- Each session duration: 20-30mins
- Usually performed twice a week for 3 weeks
- The sessions can be tailored on patient preference after discussing with the Consultant Genito-Urinary Surgeon or Physician



For any information and clarifications



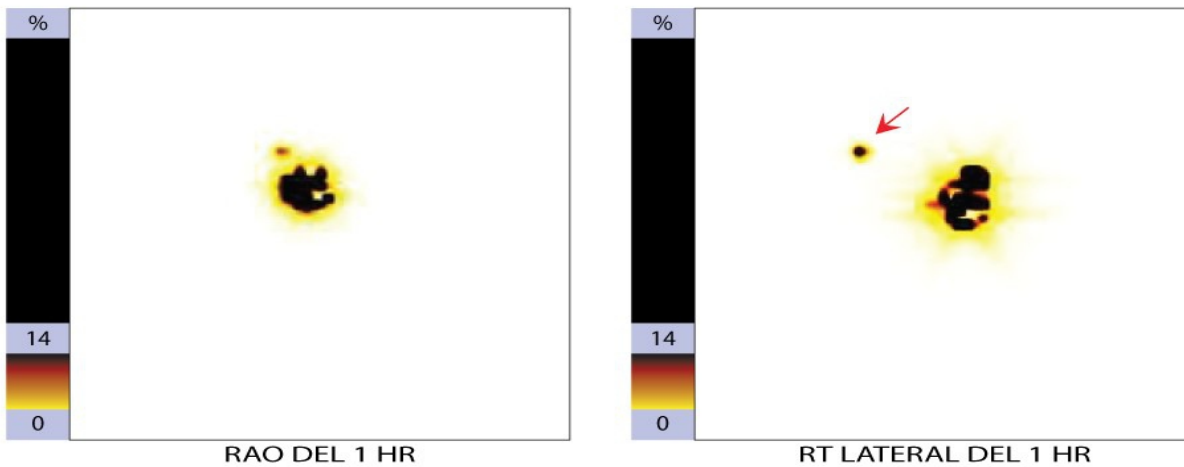


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Tumour budding : an emerging prognostic factor in colorectal carcinoma

Bimalka Seneviratne, Bawantha Gamage

Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka

Key words: Equitable care; endocrine surgery

Abstract

Tumour budding, is a morphological feature seen in colorectal carcinoma and known to be associated with a poor outcome. It is thought to be representing the phenomenon of epithelial-mesenchymal transition of colorectal carcinoma. Colorectal malignancies exhibiting budding have shown an association with lymphatic invasion and lymph node metastasis. In addition tumour budding has proven to be associated with tumour recurrence and is a negative prognostic indicator of overall survival of patients with colorectal carcinoma.

Objectives of the study was to assess the prevalence of tumour budding in CRC (higher colorectal carcinoma) specimens and to determine the association between tumour budding and the histological grade, nodal involvement and tumour recurrence.

A retrospective study was carried out at the Department of Pathology, Faculty of Medical Sciences, University of Sri Jayewardenepura. The study sample included 58 cases of colorectal carcinoma during the period January 2015 to June 2018. The histological grade, nodal status and tumour recurrence was recorded following review of histology slides. In addition, the slides were examined for the presence or absence of tumour budding, according to the ITBCC (November 2016) recommendations.

Study population showed a tumour budding percentage of 32.75%. Tumour budding in colorectal carcinoma showed a statistically significant association with high histological grade, lymph nodal involvement and tumour recurrence (p value < 0.05).

Tumour budding in CRC is strongly predictive of high histological grade, lymph node metastases, and tumour recurrence. The study population included 02 cases of tumour recurrence in the budding group, and a single case of

cancer related deaths.

Introduction

Tumour budding which is being widely discussed in many centres, is likely to be emerging as a novel prognostic marker in colorectal carcinoma [1]. Numerous studies have shown the clinical significance of tumour budding as an independent risk factor which is associated with an adverse outcome [2].

Tumour budding is assessed at the invasive front of colorectal carcinoma. The presence of budding is confirmed by finding of detached tumour cells either singly or in small clusters within the surrounding stroma [3]. Tumour budding, is a histomorphological biomarker associated with an adverse outcome. It represents de-differentiation of epithelial cells into more aggressive phenotypes (figure 1,2). Tumour budding in colorectal carcinoma has shown to be significantly associated with lymphatic invasion and lymph node metastases [4]. In addition it is a negative prognostic indicator in relation to overall survival. Inclusion of this morphological parameter into the CRC staging algorithm may be clinically relevant, but will require consensus opinion on the pathological description of tumour budding [5].

In view of arriving at a consensus opinion a panel of experts discussed the issues related to standardized reporting of tumor budding in colorectal carcinoma, at the International Tumour Budding Consensus Conference (ITBCC) held in Bern, Switzerland, in November 2016.


The primary goal of the ITBCC was to reach agreement on an international, evidence-based and reproducible scoring system for histological reporting of tumor budding [6]. The definition, evaluation, severity and interpretation of tumour budding were some of the key areas discussed in detail at this conference [7] Recommendations of the ITBCC, which achieved consensus have been incorporated into the CAP cancer protocol for the handling of specimens of colorectal carcinoma.

There were total of 11 recommendations of the ITBCC. From the total of 11 recommendations, ten were able to achieve 100 % agreement from the panel members. One recommendation

Correspondence: Bawantha Gamage

E-mail: bawantha@sjp.ac.lk

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 <http://orcid.org/0000-0003-4381-228X>

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was agreed upon by 96% (No. 5 below) of the panelists.

The suggestions 1, 5, 7 through 9, and 11 have been included into the CAP cancer protocol as the recommended method for assessing tumour budding in colorectal carcinoma. Further to this the Royal College of Pathologists of the United Kingdom (V4, December 2017) has acknowledged ITBCC in pathology reporting guidelines for colorectal carcinoma. To determine tumour budding it is mandatory to examine the entire invasive front of the tumour under the light microscope. A single “hot spot” needs to be selected after carefully assessing the hematoxylin & eosin stained tissue sections of the invasive front (defined as single tumour cells or clusters of up to 4 tumour cells), with an $\times 20$ objective lens. As the microscopic field diameters vary, the application of a correction factor has been suggested to report the number of tumour buds in the equivalent of a 0.785-mm² field. The tumour bud score has been determined by using a 3-tiered system based on the number of tumour buds in a 0.785-mm² field (low, 0–5 tumour buds; intermediate, 6–9 tumour buds; high, 10 or more tumour buds).

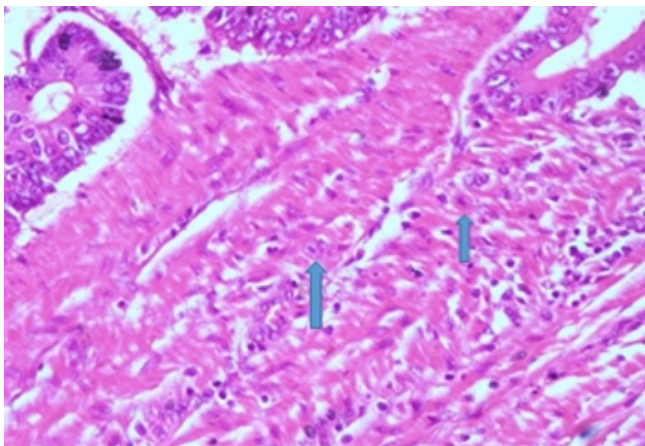


Figure 1. Moderately-differentiated adenocarcinoma of rectum exhibiting tumour budding (detached tumour cells at the advancing edge-arrows). H&E stain $\times 100$

However, it is widely acknowledged that additional studies will be required to address the challenges in uniform reporting of tumour budding [8].

Objectives

To assess the prevalence of tumour budding in CRC specimens and determine the association between tumour budding and the histological grade, nodal involvement and tumour recurrence.

Methodology

A retrospective study was carried out at the Department of Pathology, Faculty of Medical Sciences, University of Sri Jayewardenepura. The study sample included 58 cases of colorectal carcinoma during the period January 2015 to June 2018. Specimens that have been handled and processed according to the standard guidelines were included in the study group. Following tissue processing, 3 μ m thick sections have been prepared for staining with the routine hematoxylin and eosin method.

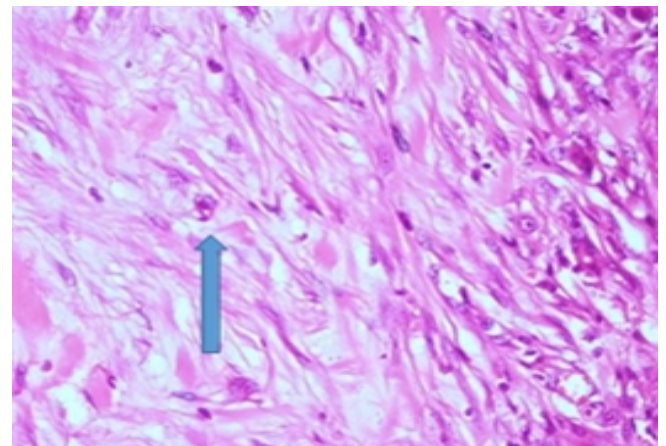


Figure 2. Single cells (tumour budding) at the advancing edge of moderately differentiated adenocarcinoma of rectum (arrows). H&E stain $\times 100$

Recommendations of the ITBCC are as follows;

1.	Tumour budding is defined as a single tumour cell or a cell cluster of up to 4 tumour cells.
2.	Tumour budding is an independent predictor of lymph node metastasis in pT1 colorectal cancer.
3.	Tumour budding is an independent predictor of survival in stage II colorectal cancer.
4.	Tumour budding should be taken into account along with other clinicopathologic factors in a multidisciplinary setting.
5.	Tumour budding is counted on hematoxylin-eosin (H&E).
6.	Intratumoral tumour budding in colorectal cancer has been shown to be related to lymph node metastasis.
7.	Tumour budding is assessed in 1 hotspot (in a field measuring 0.785 mm ²) at the invasive front.
8.	For tumour budding assessment in colorectal cancer, the hotspot method is recommended.
9.	A 3-tier system should be used along with the budding count to facilitate risk stratification in colorectal cancer.
10.	Tumour budding should be included in guidelines/protocols for colorectal cancer reporting.
11.	Tumour budding and tumour grade are not the same.

Poor quality slides were re-stained, and the histological diagnoses of all the cases were reviewed independently by two pathologists and confirmed. Prognostic information such as tumour grade and lymph nodal status were also recorded, after examining the histology slides. In addition, the slides were examined for the presence or absence of tumour budding, according to the ITBCC (November 2016) recommendations. Data was tabulated without revealing the identification details. Information with regard to tumour recurrence was extracted from the data base.

Inclusion criteria:

- Colorectal carcinoma specimens during the study period, from January 2015 to June 2018, in which the histology slides and paraffin blocks were available.

Exclusion criteria:

- Colorectal carcinoma specimens during the study period (January 2015 to June 2018), with no clinical details.
- Colorectal carcinoma specimens during the above period with no available histology slides or paraffin blocks.

Discussion

Study population showed a tumour budding percentage of 32.75% (table 1). Tumour budding in colorectal carcinoma showed a statistically significant association (p value < 0.05) with high histological grade (poorly differentiated), lymph nodal involvement, and tumour recurrence (distant).

The results of the research have been similar to multiple studies done in tertiary referral centres in other parts of the globe, although the smaller sample size of the current study

Results

Tumour budding	Grade	Stage (TNM)	Lymph nodal involvement	Completeness of resection (circumferential resection margin)	Recurrence
Tumour budding (+) n = 19 (32.75%)	High - 16 Low - 03	I - 02 IIA- 04 IIB- 00 IIC- 00 IIIA- 01 IIIB- 12 IIIC- 00 IV - 00	present -13 absent - 03	CRM – uninvolved (> 2 mm)	n= 02 (distant)
Tumour budding (-) n =39 (67.24%)	High - 27 Low - 12	I - 04 IIA- 22 IIB- 04 IIC- 00 IIIA- 04 IIIB- 05 IIIC- 00 IV - 00	present -07 absent - 32	CRM – uninvolved (> 2 mm)	n= 0

Tumour budding vs	True Positives	All positives	PPV %	True Negatives	All Negatives	NPV%
High- grade tumours	16	35 (all high - grade)	45.71	03	23 (all low- grade)	13.04
Low- grade tumours	3	23 (all low-grade)	13.04	16	35 (all high-grade)	45.71
Lymph nodal involvement	13	19	68.42	06	39	15.38
Recurrence	02	02	100	17	56	30.35

was considered as a major limiting factor [9]. A multicentre study with the participation of a larger number of patients from different regions, will be the next step to evaluate the impact of tumour budding in a Sri Lankan perspective.

Collaborative studies conducted by Ishikawa Y, Aishima-Fukasawa Y et al [10], has shown a significant association between tumour budding and lymphatic invasion thus leading to lymph node involvement.

More comprehensive studies done in a larger cohort of patients by Lugli et al [2], Van Wyk HC et al [5], have shown that tumour budding is a negative prognostic indicator in relation to tumour recurrence and overall survival of CRC patients. Studies done by Choi JY et al [11], and Di Gregorio C et al [12] have been able to highlight the association of tumour budding and distant metastasis.

Research done by Glasgow SC et al and Mou S et al further strengthened the concept of tumour budding as an emerging prognostic factor of colorectal carcinoma [13, 14].

Multicentre studies concluded by Petrelli F [15] and Rogers AC [16] also have emphasized the adverse relationship between tumour budding and colorectal carcinoma.

The TNM staging system for colorectal carcinoma separates patients into different categories. Management of patients to a great extent depends on the stage of the disease. However, there is significant diversity in relation to the prognosis among the patients with CRC of a similar stage [17]. Currently there is no superior method of staging which has been validated [18]. The future of CRC will depend on the identification of novel, clinically relevant prognostic markers which would have an impact on the disease free interval and cancer related deaths. Better correlation with the prognostic markers would enable to reduce under and over treatment of patients with CRC. Treatment related parameters have the potential to revolutionize the outcome of colorectal carcinoma [19].

In spite of all the current information tumour budding has not been included in the TNM staging of colorectal carcinoma, largely due to the lack of consensus with regard to its definition and method of detection in routine histology sections. Many studies have addressed the issue of “reproducibility” of the assessment method and results [20]. Another concern when trying to incorporate tumour budding into clinical practice is the lack of a suitable method of detection for all stages of CRC [21]. Some methods for reporting refer to early stages (I, II) and some are for advanced disease [22].

However, those tumours exhibiting budding certainly are worth considering as a subset to target with adjuvant chemotherapy in CRC as a whole (xiv, xv). Results would certainly have beneficial effects on long term survival of patients with colorectal carcinoma.

Conclusion

Tumour budding in CRC shows significant association with high histological grade, lymph nodal involvement and recurrence. The study population included 02 cases of tumour recurrence in the budding group, and a single case of cancer related deaths, despite the smaller sample size which was considered as a major limiting factor. Tumour budding has been studied predominantly at the invasive front of the tumour and is referred to as “peritumoral budding”. Inclusion of this histological finding into the CRC staging algorithm is quite necessary, but will require consensus opinion & standardization of the pathological definition of tumour budding [11]. Routine reporting of tumour bud count and severity is now being recommended. There is considerable interobserver variability with regard to the reporting of tumour budding which could be streamlined in the near future with the results of more comprehensive research [12,13] and meta-analyses. Tumour budding has been incorporated into the CAP (College of American Pathologists) protocol as a recommended element. Inclusion into the TNM stage of CRC would require more collaborative research data, but certainly would be an option that has to be considered in relation to the future management of patients with colorectal carcinoma.

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.

References

1. Koelzer VH, Zlobec I, Lugli A. Tumor budding in colorectal cancer—ready for diagnostic practice? *Hum Pathol.* 2016; 47 (1): 4–19. <https://doi.org/10.1016/j.humpath.2015.08.007>
2. Lugli A, Karamitopoulou E, Zlobec I. Tumour budding: a promising parameter in colorectal cancer. *Br J Cancer.* 2012; 106 (11): 1713–1717. <https://org/10.1038/bjc.2012.127>
3. Mitrovic B, Schaeffer DF, Riddell RH, Kirsch R. Tumor budding in colorectal carcinoma: time to take notice. *Mod Pathol.* 2012; 25 (10): 1315–1325. <https://org/10.1038/modpathol.2012.94>
4. Zlobec I, Lugli A. Prognostic and predictive factors in colorectal cancer. *Postgrad Med J* 2008; 84 (994): 403–411. <https://org/10.1136/jcp.2007.054858>
5. van Wyk HC, Park J, Roxburgh C, Horgan P, Foulis A, McMillan DC. The role of tumour budding in predicting survival in patients with primary operable colorectal cancer: a systematic review. *Cancer Treat Rev.* 2015; 41 (2): 151–159. <https://org/10.1016/j.ctrv.2014.12.007>

6. Beaton C, Twine CP, Williams GL, Radcliffe AG. Systematic review and meta-analysis of histopathological factors influencing the risk of lymph node metastasis in early colorectal cancer. *Colorectal Dis.* 2013; 15 (7): 788– 797. <https://org/10.1111/codi.12129>
7. Bosch SL, Teerenstra S, de Wilt JH, Cunningham C, Nagtegaal ID. Predicting lymph node metastasis in pT1 colorectal cancer: a systematic review of risk factors providing rationale for therapy decisions. *Endoscopy.* 2013; 45 (10): 827– 834. <https://org/10.1055/s-0033-1344238>
8. Cappelleso R, Luchini C, Veronese N, et al. Tumor budding as a risk factor for nodal metastasis in pT1 colorectal cancers: a meta-analysis. *Hum Pathol.* 2017; 65: 62– 70. <https://org/10.1016/j.humpath.2017.04.013>
9. Carrara A, Mangiola D, Pertile R, et al. Analysis of risk factors for lymph nodal involvement in early stages of rectal cancer: when can local excision be considered an appropriate treatment? Systematic review and meta-analysis of the literature. *Int J Surg Oncol.* 2012; 2012: 438450. <https://org/10.1155.2012.438450>
10. Ishikawa Y, Aishima-Fukasawa Y, Ito K et al. Histopathological determinants of regional lymph node metastasis in early colorectal cancer. *Cancer.* 2008; 112 (4): 924-933. <https://doi.org/10.1007/s00428-008-0717-3>
11. Choi JY, Jung SA, Shim KN, et al. Meta-analysis of predictive clinicopathologic factors for lymph node metastasis in patients with early colorectal carcinoma. *J Korean Med Sci.* 2015;30 (4): 398– 406. <https://org/10.3346/jkms.2015.30.4.398>
12. Di Gregorio C, Bonetti LR, de Gaetani C, Pedroni M, Kaleci S, Ponz de Leon M. Clinical outcome of low- and high-risk malignant colorectal polyps: results of a population-based study and meta-analysis of the available literature. *Intern Emerg Med.* 2014; 9 (2): 151– 160. <https://org/10.1007/s11739-012-0772-2>
13. Glasgow SC, Bleier JJ, Burgart LJ, Finne CO, Lowry AC. Meta-analysis of histopathological features of primary colorectal cancers that predict lymph node metastases. *J Gastrointest Surg.* 2012; 16 (5): 1019– 1028. <https://doi.org/10.1007/s11605-012-1827-4>
14. Mou S, Soetikno R, Shimoda T, Rouse R, Kaltenbach T. Pathologic predictive factors for lymph node metastasis in submucosal invasive (T1) colorectal cancer: a systematic review and meta-analysis. *Surg Endosc.* 2013; 27 (8): 2692– 2703. <https://doi.org/10.1007/s00464-013-2835-5>
15. Petrelli F, Pezzica E, Cabiddu M, et al. Tumour Budding and Survival in Stage II Colorectal Cancer: a Systematic Review and Pooled Analysis. *J Gastrointest Cancer.* 2015; 46 (3):212– 218. <https://doi.org/10.1007/s12029-015-9716-1>
16. Rogers AC, Winter DC, Heeney A, et al. Systematic review and meta-analysis of the impact of tumour budding in colorectal cancer. *Br J Cancer.* 2016; 115 (7): 831– 840. <https://doi.org/10.1038/bjc.2016.274>
17. Koelzer VH, Zlobec I, Berger MD et al. Tumour budding in colorectal cancer revisited; results of a multicenter interobserver study. *Virchows Arch.* 2015; 466(5): 485-493. <https://doi.org/10.1111/his.13164>
18. The Royal College of Pathologists of Australia. Colorectal cancer structured reporting protocol (3rd edition 2016). <https://www.rcpa.edu.au>
19. Schmoll H J, Van Cutsem E, Stein A et al. ESMO consensus Guidelines for management of patients with colon & rectum cancer. A personalized approach to clinical decision making. *Ann Oncol.* 2012; 23 (10): 2479-2516. <https://doi.org/10.1093/annonc/mds236>
20. Okuyama T, Oya M, Ishikawa H. Budding as a useful prognostic marker in pT3 well- or moderately differentiated rectal adenocarcinoma. *J Surg Oncol.* 2003;83 (1): 42-47. <https://doi.org/10.1002/jso.10230>
21. Nakamura T, Mitomi H, Kanazawa H, Ohkura Y, Watanabe M. Tumour budding as an index to identify high- risk patients with stage II colon cancer. *Dis Colon & Rectum.* 2008; 51 (5): 568-572. <https://doi.org/10.1007/s10350-008-9192-9>
22. Lai YH, Wu LC, PS et al. Tumour budding is a reproducible index for risk stratification of patients with stage II colon cancer. *Colorectal Dis.* 2014; 16(4): 259-264. <https://doi.org/10.1111/codi.12454>

Shifting the paradigm of peri-operative care in colorectal surgery in a Sri Lankan tertiary care unit

Bawantha Gamage

Department of Surgery, University of Sri Jayewardenepura, Sri Lanka

Keywords: Colorectal surgery; enhanced recovery after surgery; peri-operative care; pelvic MRI

Abstract

Enhanced recovery after colorectal surgery (ERAS) protocol is a multimodal perioperative care pathway aiming to reduce stress response to surgery. It helps to return to normal physiology at earliest with minimum complications compared to traditional care pathway in colorectal surgery. In order to have intended benefits of ERAS, accurate staging of the patients with colorectal cancer is invaluable. Pre-treatment pelvic MRI scan is the gold standard in rectal cancer staging due to its proven benefits.

While preoperative MRI scan in rectal cancer patients with internationally recognized reporting protocol has been encouraged, ERAS with some modifications (mERAS) has been introduced at the university surgical unit of the Colombo south teaching hospital to overcome the resource limitations at local setting.

Modified ERAS protocol was well tolerated by our cohort of patients and the favourable outcomes of ERAS protocol in our centre are comparable with published data. Therefore mERAS would be a safe alternative to the traditional practice of colorectal surgery in Sri Lanka.

This article describes the methods of mERAS implementation and the strategies adhered in shifting the paradigm of perioperative care in colorectal surgery at our centre.

Introduction

The outcome of colorectal surgery for cancer depends on the operative technique, accurate local staging and evidence based peri operative management. In traditional practice of rectal cancer staging in Sri Lanka, contrast enhanced computerised tomographic scan (CECT) of the pelvis has been the investigation used in local staging of rectal cancers in most of the centres; magnetic resonance imaging (MRI) has not been widely employed mainly due to non-availability. In

addition preoperative prolonged fasting, use of oral mechanical bowel preparation, nasogastric tubes, routine drains and prolonged postoperative 'nil by mouth' regimes have been considered to be essential. The average hospital stay after traditional practice of colorectal surgery has historically been reported to be between 7 and 12 days [1,2].

The recommendation for local staging of patients with rectal cancer is MRI of the pelvis [3]. The MERCURY study group in rectal cancer has shown that high resolution MRI will accurately predict the involvement of the surgical resection margin in rectal cancer [4]. The result of this investigation will determine whether the patient would need neoadjuvant treatment prior to surgery. Making management decisions without accurate staging would lead to delay in recovery and poor outcome. Therefore, steps taken to enhance post-operative recovery should be preceded by accurate staging of the disease.

The concept of augmented postoperative recovery was first described by Danish Professor Henrik Kehlet in the late 1990s although he did not use the term "Enhanced Recovery After Surgery" [5]. He extensively studied on pathophysiology of surgery, attenuating surgical stress, multimodal analgesia in managing postoperative pain and employed a protocol in managing patients in the peri-operative period [5, 6]. The work led to the concept of "Fast-Track-Surgery".


The principal aim of the ERAS protocol is to attenuate the stress response to surgery by optimizing the patient's normal physiology. This resulted in speeding up recovery and promoted early return to normal activities [6]. Several alterations to the original protocols have been added with the introduction of minimally invasive surgery and accumulating new evidence. A group of academic surgeons who worked tirelessly on this subject formed the ERAS society in early 2000. Their mission was to "develop perioperative care and to improve recovery through research, education, audit and implementation of evidence-based practice" [7].

ERAS has been associated with reduced postoperative hospital stay to 3-5 days [5] and early return to normal activity with low complication rates [8] without compromising oncological outcome. Summary of steps of ERAS is outlined in Table 1 [9,10].

Correspondence: Bawantha Gamage

E-mail: bawantha@sjp.ac.lk

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 <http://orcid.org/0000-0003-4381-228X>

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Table 1- Summary of ERAS
Preoperative interventions
1. Preoperative patient education and counselling
2. Optimizing comorbidities
3. Selective use of bowel preparation/ use of antibiotic associated mechanical bowel preparation
4. Minimal preoperative fasting
5. Preoperative thromboembolism prophylaxis
6. Preoperative carbohydrate loading
Perioperative interventions
1. Minimally invasive surgery
2. Antibiotic prophylaxis
3. Avoid opioids
4. Postoperative nausea and vomiting prophylaxis
5. Prevent hypothermia
6. Goal directed fluid therapy
7. Avoid routine drains and nasogastric tubes
Postoperative interventions
1. Early and progressive mobilization
2. Early oral feeding
3. Early removal of drains/ catheters/ NG tubes
4. Early discharge

Though evidence based, ERAS has yet to be firmly established in Sri Lanka. One reason may be the limitations of resources to follow all steps of the protocol. The ERAS protocol was initiated with some modifications at the University Surgical Unit of the Colombo South Teaching Hospital with the aim of assessing the outcome of mERAS among our patient cohort.

Table 2. Modified steps of ERAS protocol	
Standard ERAS protocol	Modifications we made at CSTH
Admit on the day of the surgery	Admit on the day prior to surgery
Epidural for open but not for laparoscopic resections, free use of patient controlled anaesthesia (PCA)	Frequent use of epidural anaesthesia (due to lack of patient-controlled analgesia devices)
Intra operative non-invasive goal directed fluid therapy	Intraoperative CVP guided fluid therapy
NG tubes are not recommended	NG tube was inserted and kept for 24 hours
No drains recommended	Selective use of drains in low anterior resection (AR), proctocolectomy and abdominoperineal resection (APR).
Post op Routine ICU care not recommended	Routine post op ICU/HDU care given in the first 24 hours postoperatively.
Early discharge from hospital (3-5days)	Discharge after normal diet is consumed and when mobile 5-6 days, due to the paucity of community based care.

Methodology

Preoperative staging pelvic MRI in rectal cancer patients

To stage rectal cancer accurately, an MRI of the pelvis was performed and was reported according to standard protocol, which highlighted the circumferential resection margin (CRM), extramural vascular invasion (EMVI) and the lateral pelvic side wall involvement (LPSWI) [11].

Management decisions were made at the colorectal multidisciplinary team (MDT) meetings after discussing the result of pelvic MRI and CECT of the abdomen, amongst other criteria such as fitness for anaesthesia. This was considered a vital step in management in order to subject the patients to the modified ERAS protocol.

Application of modified ERAS (mERAS) protocol :

All steps of ERAS were not possible in Sri Lanka due to resource limitations. While preserving the principles of ERAS, the following modifications were made to overcome the limitations in our local setting (table 2).

All other steps of the standard ERAS have been followed accordingly.

The introduction of this prospective descriptive study of mERAS at the University Surgical Unit, CSTH, which was designed to evaluate the outcome of patients having surgery for colorectal cancer, was approved by the Ethics Review Committee of the Faculty of Medical Sciences University of Sri Jayewardenepura.

Patient recruitment

All patients were admitted under the care of a single surgeon for elective colorectal resections, and who gave informed consent to follow the mERAS protocol, were included in the study. Patients who required emergency colorectal resections were excluded.

Data collection and analysis

Data on preoperative preparation, surgery, postoperative care and complications have been recorded in a colorectal data base in all the patients included in this study. Data from 2011 to 2017 were evaluated. Analysis was done using SPSS data software(IBM SPSS Statistics for Windows, Version 23.0. Armonk, New York, USA: IBM Corp.)

Results

Demographic data

One hundred and twelve patients (median age - 60 years, range 23 to 88 years) underwent colon and rectal cancer resection during this study period. The ratio of male to female was 1.08: 1.

Mode of surgery

Laparoscopic resections were performed in 71.4% of the study cohort (Figure. 1).The overall conversion rate was 8.9 %. The number of laparoscopic resections performed per year has increased over time. (Figure.2).

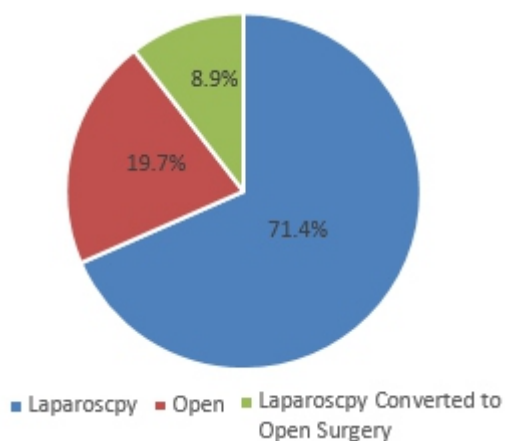


Figure 1. Method of resection

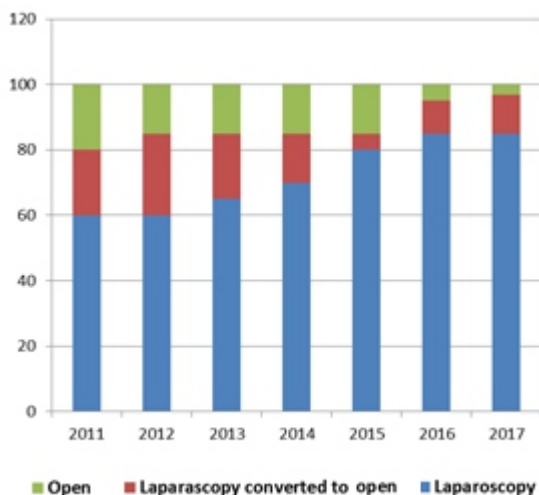


Figure 2. Trend of modes of surgery

Staging pelvic MRI scan in patients with rectal cancer

MRI was performed in rectal cancer patients for accurate local staging of the disease. The percentages have been increasing over the years, and now, more than 90 % of patients with rectal cancer will have a pelvic MRI as the investigation of choice in local staging provided they do not have contraindications (Figure 3).

Adherence to the steps of ERAS

All patients were admitted one day prior to surgery as lack of proper transport facility did not allow same day admission. All the patients were educated on the perioperative care plan and their concerns were acknowledged. Preoperative thromboembolism prophylaxis was started with single dose of subcutaneous low molecular weight heparin in all patients.

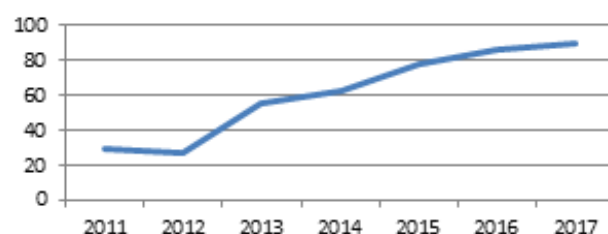


Figure 3. Percentage of MRI Scans performed for rectal cancers

A phosphate enema was administered early on the morning of the day of surgery in the case of left colonic and rectal resections (84%). No bowel preparation was used in right and transverse colon resections. Patients were requested to fast for a period of 6 hours for solids and 2 hours before surgery for clear fluids. Carbohydrate loading was given on the previous day of surgery as well as 2 hours prior to surgery. Antibiotic prophylaxis was given to all the patients prior to the induction of anaesthesia. Epidural anaesthesia was used frequently due to the unavailability of patient controlled anaesthesia devices. It was used in all open resections(19.7 %). CVP guided fluid therapy was used instead of goal directed fluid therapy as oesophageal doppler monitoring facilities were not available. Intraperitoneal drains were inserted in all cases of low anterior resection (48%), abdominoperineal resection and total proctocolectomy. The median number of days to resume normal diet, mobilise, removal of the urinary catheter and drains, including stay in intensive care are shown in Figure. 4.

Oral fluids were started by the evening of the same day of surgery, and normal diet the following day, in the absence of post-operative nausea and vomiting. By day 3 after surgery, 70% of patients had a bowel movement. The median duration of hospital stay was 5 days (range 3-21 days).

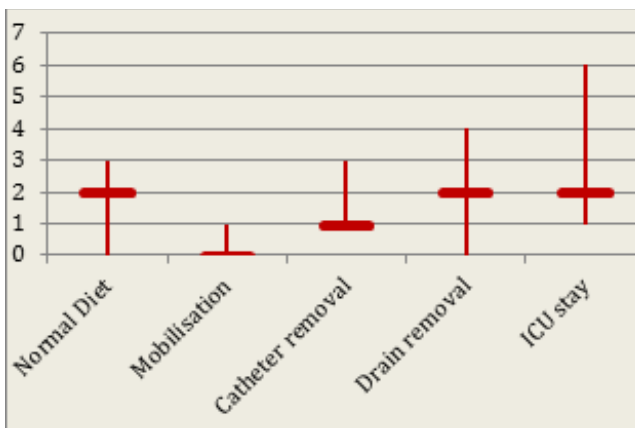


Figure 4. Post-operative care (Median days)

Postoperative complications

In the first 30 days after surgery, the following complications (Clavien-Dindo > 2) were reported in our cohort; surgical site infection -17.85%, respiratory tract infection- 4.4%, urinary tract infection -2.6% and anastomotic leaks – 3.5%. All anastomotic leaks were in patients who underwent low AR (n=4), and who had had neoadjuvant chemo-radiotherapy. All leaks were identified within the first 5 days post-operation; three required re-laparotomy. 30-Day mortality was zero in this cohort.

Discussion

Role of preoperative MRI scan in rectal cancer

The MERCURY study group demonstrated the accuracy of pelvic MRI in delineating the anatomy of mesorectal fascia and future surgical clearance [4]. Also, the study showed that preoperative prognostication can be done by accurate measurement of extramural tumor spread [12, 13]. The National Comprehensive Cancer network (NCCN) guideline on rectal cancer recommends preoperative pelvic MRI scans in all patients with rectal cancer [3]. To be an effective tool in preoperative evaluation, standardization of the technique of MRI and reporting is vital [11]. In our study the number of patients having pre-operative pelvic MRI for rectal cancer has been increasing, which has helped the predictability at our MDT meetings.

Outcome of mERAS at local setting

Modified ERAS protocol has been well tolerated by our cohort of patients. Published data on this aspect in local setting is scarce and we could not find similar studies to compare with our results. Similar studies with ERAS protocol have been published from developed countries. One meta-analysis, which included 6 randomized control trials comparing conventional practice and ERAS in open colorectal surgery, has mentioned that only a mean of 9 (range- 4 to 12) elements of the ERAS protocol were used in those trials [8]. This meta-analysis has shown that ERAS is associated with

reduced time of hospital stay and postoperative complication rates after open colorectal surgery without compromising patient safety [8]. In our study group, the modifications were done while sticking to the principles of ERAS, in order to overcome the limitation of resources at local setting.

A Japanese study of 257 patients undergoing ERAS protocol, has shown reduction of postoperative hospital stay by 3 days from 10 days to 7 days. This was a statistically significant difference, without adversely affecting the short term outcome [14]. Reduction of postoperative hospital stay to a median of 4 days has been reported with the implementation of ERAS in a study from Belgium [15]. All procedures were laparoscopic with a 9.5 % conversion rate and a reported 2.1 % anastomotic leaks. The authors have suggested widespread implementation of ERAS principles for cost effective use of healthcare [15]. A larger Italian study comprising 1065 patients reported an average 3 days of hospital stay with no difference in complication rates [16].

Our results of implementing ERAS with modifications are comparable with these published data. The modifications that we undertook helped overcome resource limitations at our local setting.

How this paradigm shift was made possible

Initiation of a change is always a challenge, and sustenance of change is even more challenging. The following approaches were adopted to overcome these challenges and to make the protocol sustainable.

1. Formal introduction on modified ERAS was given to both the ward staff and the anaesthetic team. All steps were properly explained. The advantages of the new protocol were highlighted.
2. Laparoscopy facilities at our centre were upgraded.
3. A dedicated stoma nurse was trained. The nurse was able to build good rapport with the patient and trained the patient as well as the patient's immediate care takers.
4. The unit protocol was clearly drafted and distributed among the staff. All their concerns were acknowledged and implemented if appropriate.
5. Patient information leaflets and consent forms were distributed to the patients prior to the surgery.
6. A system was developed to record data of all procedures which enabled frequent evaluation of the unit protocol.
7. A Colorectal Multi-Disciplinary Team (MDT) meeting was started, which involved surgeons, pathologists, radiologists, an oncologist and a stoma care nurse.
8. Two books were published with the aim of educating patients and the public on colorectal diseases and the ERAS programme.

Conclusions

We recommend staging pelvic MRI as the investigation of choice for local staging in rectal cancer, which should be reported by radiologists trained in rectal cancer MRI, and which should be the focal point of discussion at a colorectal MDT. The modified ERAS protocol was well tolerated by our cohort of patients and the favourable outcomes of ERAS at our centre were comparable with published data. The adoption of the ERAS protocol with some modifications to suit the local setting would be a development to current traditional practice of colorectal surgery for colorectal cancer in Sri Lanka.

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.

References

1. Schoetz DJ, Bockler M, Rosenblatt MS, Malhotra S, Roberts PL, Murray JJ, Collier JA, Rusin LC. "Ideal" length of stay after colectomy. *Diseases of the colon & rectum*. 1997 Jul 1;40(7):806-10. <https://doi.org/10.1007/bf02055437>
2. Retchin SM, Penberthy L, Desch C, Brown R, Jerome-D'Emilia B, Clement D. Perioperative management of colon cancer under Medicare risk programs. *Archives of internal medicine*. 1997 Sep 8;157(16):1878-84. <https://doi.org/10.1001/archinte.1997.00440370126013>
3. Engstrom PF, Arnoletti JP, Benson AB, Chen YJ, Choti MA, Cooper HS, Covey A, Dilawari RA, Early DS, Enzinger PC, Fakih MG. Rectal cancer. *Journal of the National Comprehensive Cancer Network*. 2009 Sep 1;7(8):838-81. <https://doi.org/10.6004/jnccn.2009.0057>
4. MERCURY Study Group. Diagnostic accuracy of preoperative magnetic resonance imaging in predicting curative resection of rectal cancer: prospective observational study. *Bmj*. 2006 Oct 12;333(7572):779. <https://doi.org/BMJ2006;333:779>
5. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *British journal of anaesthesia*. 1997 May 1;78(5):606-17. <https://doi.org/10.1093/bja/78.5.606>
6. Basse L, Jakobsen DH, Billesbølle P, Werner M, Kehlet H. A clinical pathway to accelerate recovery after colonic resection. *Annals of surgery*. 2000 Jul;232(1):51. <http://erassociety.org/about/history>
8. Varadhan KK, Neal KR, Dejong CH, Fearon KC, Ljungqvist O, Lobo DN. The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: a meta-analysis of randomized controlled trials. *Clinical nutrition*. 2010 Aug 1;29(4):434-40. <https://doi.org/10.1016/j.clnu.2010.01.004>
9. Carmichael JC, Keller DS, Baldini G, Bordeianou L, Weiss E, Lee L, Boutros M, McClane J, Feldman LS, Steele SR. Clinical practice guidelines for enhanced recovery after colon and rectal surgery from the American Society of Colon and Rectal Surgeons and Society of American Gastrointestinal and Endoscopic Surgeons. *Diseases of the Colon & Rectum*. 2017 Aug 1;60(8):761-84. <https://doi.org/10.1097/DCR.0000000000000883>
10. Lassen K, Soop M, Nygren J, Cox PB, Hendry PO, Spies C, von Meyenfeldt MF, Fearon KC, Revhaug A, Norderval S, Ljungqvist O. Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations. *Archives of surgery*. 2009 Oct 19;144(10):961-9. <https://doi.org/10.1001/archsurg.2009.170>
11. Taylor F G, Swift R I, Blomqvist L, Brown G. A systematic approach to the interpretation of preoperative staging MRI for rectal cancer. *American Journal of Roentgenology*. 2008 Dec;191(6):1827-35. <https://doi.org/10.2214/AJR.08.1004>
12. MERCURY Study Group. Extramural depth of tumor invasion at thin-section MR in patients with rectal cancer: results of the MERCURY study. *Radiology*. 2007 Apr;243(1):132. <https://doi.org/10.1148/radiol.2431051825>
13. Taylor FG, Quirke P, Heald RJ, Moran B, Blomqvist L, Swift I, Sebag-Montefiore DJ, Tekkis P, Brown G. Preoperative high-resolution magnetic resonance imaging can identify good prognosis stage I, II, and III rectal cancer best managed by surgery alone: a prospective, multicenter, European study. *Annals of surgery*. 2011 Apr 1;253(4):711-9. <https://doi.org/10.1097/SLA.0b013e31820b8d52>
14. Shida D, Tagawa K, Inada K, Nasu K, Seyama Y, Maeshiro T, Miyamoto S, Inoue S, Umekita N. Enhanced recovery after surgery (ERAS) protocols for colorectal cancer in Japan. *BMC surgery*. 2015 Dec;15(1):90. <https://doi.org/10.1186/s12893-015-0079-0>
15. Fierens J, Wolthuis AM, Penninckx F, D'Hoore A. Enhanced recovery after surgery (ERAS) protocol: Prospective study of outcome in colorectal surgery. *Acta Chir Belg*. 2012;112(5):355-8. <https://doi.org/10.1080/00015458.2012.11680851>
16. Lucchi A, Berti P, Gabbianelli C, Siani L, Vitolo GC, Grassia M, Vandi F, Maffi MF, Garulli G. Eras in laparoscopic colorectal surgery: 8 years of experience. *European Journal of Surgical Oncology*. 2016 Oct 1;42(10):S216. <https://doi.org/10.1016/j.ejso.2016.04.050>

Percutaneous renal stone surgery: redefining the better technique and lessons learnt in a developing country

N. Seneviratne
Sri Jayewardenepura General Hospital

Keywords: Percutaneous renal stone surgery; percutaneous nephrolithotomy; supine; mini-PCNL

The increasing global prevalence in nephrolithiasis continues to burden the health care delivery system of industrialized nations and takes a disproportionately high humanitarian toll on populations of the developing world. WHO has identified kidney stones to be one of the major neglected non-communicable disease (NCDs) accounting for a significant proportion of kidney failures in long term [1]. Life time incidence of kidney stones is 13% for men and 7% in women². Once an individual has formed a stone, the likelihood of a recurrence is 50% or greater at five years [2].

Hippocrates, the famous Greek physician, removed an infected stone from a perinephric abscess [3]. In the past open renal stone surgery has been the method of choice, namely pyelolithotomy, nephrolithotomy, which required large flank incisions. Such extensive surgery resulted in considerable pain requiring high analgesic dosing, delayed ambulation, prolonged hospital stay and eventually delayed return to normalcy. Recurrence of renal stone disease is fairly common in the tropics. There-fore performing repeated open renal surgery is difficult in the presence of peri-renal scar tissue which can result in complications such as haemorrhage, chronic scar pain, anterolateral abdominal wall weakness resulting in incisional hernia. There can also be poor cosmesis. Therefore open renal stone surgery is now becoming almost a unheard type of surgery even in low income countries.

Due to above mentioned draw backs, PCNL is widely used and has almost completely replaced open surgery for removal of large renal stones worldwide. It is performed through a skin incision 1 cm or less has revolutionized renal stone management.

It was in 1941 when Rupel and Brown first reported the use of a nephrostomy tract to remove residual stone from open

surgery using the rigid cystoscope. The first successful removal of a renal stone by percutaneous method was performed in 1976 by Fernstrom and Johansson under radiological guidance [4]. In the 1980's PCNL underwent a rapid evolution following advancement in technology with an overall paradigm shift towards minimally invasive stone surgery. Since then PCNL has become the preferred method of treating large and complex renal stones.

The two other major treatment modalities to treat renal stones are shockwave-lithotripsy (SWL) and flexible ureterorenoscopy. SWL being non-invasive, but often requires multiple sessions since stones formed in the tropics are relatively hard. On the other hand flexible ureterorenoscopy is also a minimally invasive technique where with the aid of endoscopy stones are fragmented using laser technology. It is a relatively non-invasive procedure, more often two staged and costly when treating large stones.


Meta-analysis comparing the three techniques to treat renal stones clearly have demonstrated that best stone free rates are achieved by PCNL, having a higher success rate for clearing stones in one setting compared with other techniques such as SWL and ureteroscopy [5,6]. According to the European Association of Urology (EAU) and American guidelines, management of renal stones through percutaneous techniques is the first line treatment for renal pelvic stones greater than 20 mm. The other indications being calyceal stones larger than 15 mm or sizeable lower polar stones with unfavorable anatomy which includes steep infundibulopelvic angle, and stone proximal to a long or stenosed infundibulum. In addition for stones that are too difficult to disintegrate by SWL or ureteroscopy, PCNL is beneficial [7].

A perfect percutaneous access is “key” to success in PCNL. Optimal positioning of the patients is one of the most crucial steps to gain the correct access to the stone while ensuring patient safety. PCNL has been traditionally performed in the prone position. The widely accepted conventional prone position was chosen because it was believed that this would be the safest and shortest way to approach the kidney. The technique was developed as a three-step procedure. First the patient is positioned supine, to give general anesthesia and gain retrograde access to the upper urinary tract. Then the

Correspondence: Niroshan Seneviratne

E-mail: neerosene@yahoo.com

Received: 17-12-2018 Accepted: 27-12-2018

 <http://orcid.org/0000-0003-0011-9725>

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patient is turned prone for the main part of the procedure as prone position provides a posterior access to the collecting system through the lumbar region. Finally, the patient is turned back to supine position to recover from anaesthesia.

Unfortunately, this commonly used prone position has a number of drawbacks. It is known to be an anaesthetist unfriendly position. Safe positioning back and forth from supine to prone and again to supine requires minimum of six trained individuals, (one for the head, two on either side and one controlling the legs and the feet). Finding such trained personnel twice for a single surgery can be difficult in the local theater setup. It is unfavorable in patients with cardiopulmonary disease, severe obesity as it compresses the abdomen causing a rise in abdominal pressure in spite of specially designed cushions placed under the hemiabdomen.

Prone position increases the functional residual capacity while decreasing the expiratory lung volume and total lung capacity, all of which will contribute towards ventilation perfusion mismatch. Endotracheal tube must be secured carefully as accidental extubation and loss of airway will be disastrous in the prone position. Also, unrecognized neck flexion during prone position leads to ET tube movement far in to the right main bronchus. This can lead to one lung ventilation, increased airway pressure, lung collapse and hypoxia. Prone position has predictable effects on the cardiovascular system. Abdominal compression results in compression of the inferior vena cava resulting in reduced cardiac output, venous stasis and may lead to thrombotic complications. It is very difficult or almost impossible for the anaesthetist to manage a cardio-respiratory emergency in the prone position. This will obviously involve some delay in turning the patient back to a supine position. Although prone defibrillation and CPR has been described, it is not something that most clinicians, even anaesthetists are familiar with. Also in prone position one must take great care of the pressure points since it has a high possibility of pressure injury especially the globe of the eye causing visual impairment and peripheral nerve injuries due to traction on the limbs [8-10].

While PCNL gained more popularity, it became evident that prone position was not optimal to all patients, especially those with other comorbidities, which led to introduction of alternative positions.

The supine PCNL method was first introduced by Valdivia-Uria in 1998. He approached the kidney more laterally away from the lumbar region. This was achieved by placing the patient supine with a cushion under the flank. It was not until 2007 when Ibarluzea introduced the Galdakao-Valdivia position when supine positions regain its popularity among the urological community once again. In this position, the

patient is slightly tilted from the supine position with the ipsilateral leg extended and contralateral leg flexed to achieve a modified lithotomy position [11-12]. In 2008 Barts and in 2012 Kumar further modified this position to perform supine PCNL [13].

In supine PCNL induction of anaesthesia, access to the renal tract in a retrograde fashion percutaneously, performing the PCNL and recovery from anaesthesia are all done in the same position.

Supine position has numerous advantages. The position has a low impact on the patient's cardio respiratory system. Position facilitates friendlier endotracheal tube placement and monitoring. The position also facilitates simultaneous ureteroscopy access to deal with complex stones rather than having to turn back the patient to supine position when done in the traditional prone position. Also, the position gives the accessibility to puncture the anterior and the posterior calyx separately to enter the collecting system [13].

The traditional nephrostomy tract of PCNL was dilated to 24-30F, which is referred to as "Standard-PCNL". Standard PCNL has a high stone free rate, however, at the cost of severe morbidity. To decrease the disadvantages related to standard PCNL, "mini-perc" or "mini-PCNL", with 20F or smaller tracts created, was first introduced as a pediatric procedure in 1997, and subsequently implemented in adults with the expectation of similar SFR and low morbidity [15]. Although numerous efforts have been carried out, whether mini-perc outweighs standard-PCNL for the treatment of large calculi terms of efficiency and safety remains controversial. The purpose of the present study was to share the first ever experience of supine PCNL series performed in Sri Lanka and to highlight the advantages of each technique and to compare the outcomes of prone, supine PCNL and supine mini PCNL.

Patients and method

All patients with large renal and upper ureteric calculi who were admitted from November 2013 to January 2017 to the urological unit at Sri Jayawardenapura Teaching hospital were included. During the thirty nine month period a total of 240 patients were enrolled. Patients with prior pig tail catheters inserted (DJ stenting) to the upper renal tracts and/or percutaneous nephrostomy inserted due to obstruction or infection in the kidney who underwent PCNL later, multi tract PCNL done for complete staghorn calculi or complex stones, bilateral simultaneously performed PCNL, PCNL in solitary kidney and in ectopic kidneys were excluded to have a cohort of patients with similar characteristics to facilitate the study. The study population consisted of 214 patients. Local institutional review board had approved the data collection procedures.

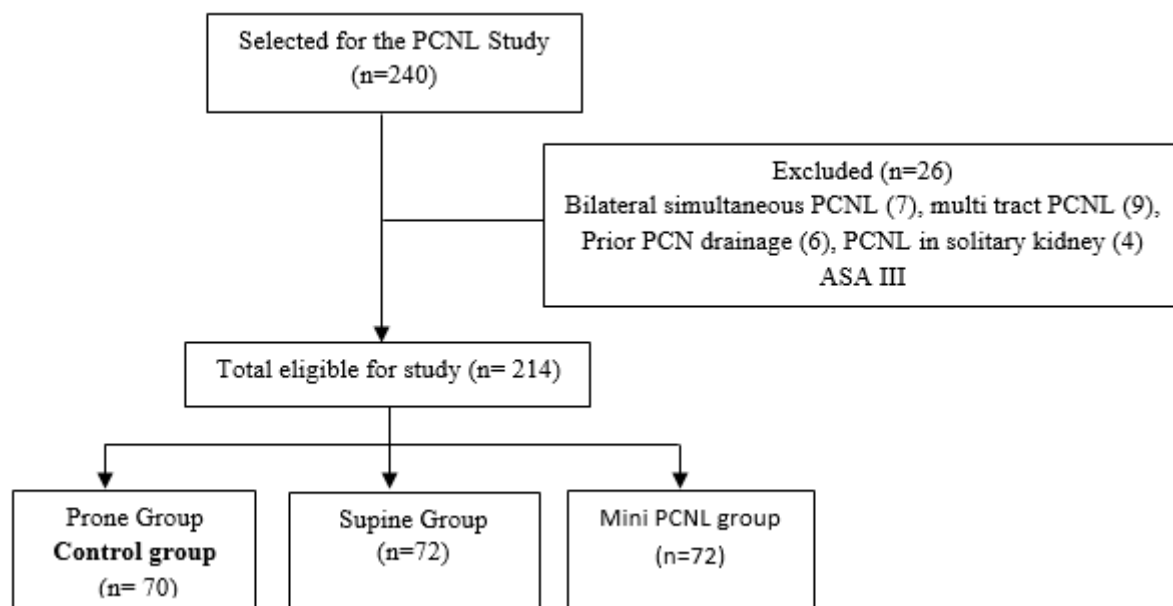


Figure 1. Study population groups

All patients underwent urine analysis and culture, renal function test, clotting profile and pre-anesthetic assessment. As imaging, a CT- KUB or when relevant a CT -Urogram especially in patients with previous open renal surgery was performed as a definitive investigation for analysis of the stone burden, location, density and pelvicalyceal anatomy. The first group, 70 patients underwent PCNL in the traditional prone position (pPCNL) while the second group (72 patients) underwent supine PCNL (sPCNL). The last group of 72 patients underwent supine mini PCNL(mPCNL) (Figure 1).

PCNL procedure

Under fluoroscopic guidance, 5 Fr ureteric catheter was inserted which allowed for injection of contrast material to obtain a pyelogram. Using 18G coaxial needle the desired calyx was punctured. Then a 0.035mm hydrophilic guide wire was passed percutaneously through the needle in to the pelvis.

Using a plastic or Alken metal dilators, fascial dilatation was done using the seldinger technique. 26-30 Fr Amplatz sheath was inserted to allow a 24fr nephroscope to enter the collecting system. Pneumatic lithotripter for less dense stones, and laser in the case of high density stones were used for fragmentation.

Once the stones burden was treated, a 22/24 Fr foley catheter was placed as the nephrostomy tube. Then the patient was stented using 6/26 double pigtail stent in an antegrade manner prior to nephrostomy insertion.

The patients in the Supine group were positioned supine after endotracheal intubation. PCNL procedure was similar to the

prone position except for the following differences:

1. There was no need to change the position of the patient after general anesthesia. Without the need for changing the patients position for three times, the patient was cleaned and draped only once.
2. Fluoroscopy tube was placed away from the working space; therefore, accidental radiation exposure directly to the surgeon's hand was prevented.
3. PCNL tract was placed in a dependent position; therefore, the irrigation fluid related intra renal pressure rise was minimal. Therefore, pyelorenal reflux is minimized. Gravity was used to ease out stone fragments with the whirlpool effect created.
4. Simultaneously access of the upper ureter, renal pelvis and the calyceal systems were performed using ureteroscopy or flexibleureteroscope to facilitate greater stone clearance
5. The PCNL procedure was performed in seated position by the surgeon. Therefore, it was more ergonomically friendly.
6. The nephrostomy tube was placed on the lateral aspect rather than on the back, which is far more comfortable for the patient postoperatively lying on the back, in bed.

In the supine Mini PCNL group the entire procedure was similar to the supine PCNL group except in two aspects. The tract created in the kidney in supine group was 26-30 FR which was around 10mm in diameter. In contrast in the mini PCNL group the tract diameter was halved to 5mm to 15Fr to accommodate the 13.5 Fr Nephroscope. Therefore, the nephrostomy tube placed, was 12 Fr.

Post operative care

The clamped nephrostomy tube was removed postoperatively after 24-48hrs depending on the stone burden treated. The urinary catheter was removed 24 hrs after nephrostomy removal and patient was discharged on postoperative day three or four.

Follow-up procedure

All patients were followed up at two weeks with urine culture and one month with X-ray KUB or CT-KUB in the case of radiolucent stone to determine the presence of residual stones. Patients with residual stones were managed with medical expulsive therapy, flexible ureterorenoscopy at the time of stent removal or extracorporeal shockwave lithotripsy. The double pigtail stent was removed at 4-6 weeks post-operatively using flexible cystoscopy under local anesthesia as a day-case procedure.

All patients were followed up for a minimum of three months and maximum of 3 years. Postoperative complications were classified according to the modified Clavien Dindo classification system 2004.

Data analysis

Apart from demographic data, stone characteristics and complexity were recorded. GUYS stone score was used to grade the complexity of stone [16].

It comprises of 4 grades:

- I. Solitary stone in mid/lower pole or solitary stone in renal pelvis with normal anatomy
- II. Solitary stone in the upper pole or solitary stone with abnormal anatomy or multiple stones with normal anatomy
- III. Multiple stones in abnormal anatomy or partial staghorn
- IV. Complete staghorn or stone in patient with spinal deformity/injury

The outcome of PCNL was interpreted in terms of success and complications. Success was defined as the absence of residual stones or clinically insignificant residual fragments (less than 4 mm) during follow up. Complications were categorized according to Modified clavien Dindo classification; 2004. Data analysis was done using SPSS V 20 using chi-square and t-test. A p value less than 0.05 was considered as significant.

Results

A total of 214 patients were eligible for the study. There was a male preponderance with male: female ratio nearly 2:1 in all 3 groups. [Table 1] Youngest was 24 years while the oldest operated was 75 years. A fair number of patients had diabetes, hypertension and dyslipidemia and were on treatment,

signifying that stone disease had a favourable relationship towards metabolic syndrome. Chronic Kidney disease co-existed in more than 10% of patients. The mean BMI was 25.74 with the majority of patients being overweight. Obesity was seen in over 10% of the population. Twenty-seven patients (12.6%) had undergone previous open renal surgery for stone disease.

Stone laterality was more or less equal in both groups [Table 2]. According to the GUYS score majority of stones were Grade 1 and II which were more equally distributed. Mean stone size of the index stone was 26 mm. Mean stone density was 1073 HU indicating that the stones were hard and not amenable for shock wave lithotripsy. Stone analysis later found that the majority of stones were hard composed of calcium oxalate monohydrate. There was no significant difference between the stone demographics between the three study groups.

The subcostal approach was selected to puncture the targeted calyx; a supracostals puncture was performed when it was not possible to reach the upper calyx [Table 3]. Lower calyceal puncture access was achieved in majority (90.6%) which was the most frequent site of the targeted puncture

All procedures were successful except in two patients, which were converted to open nephrolithotomy as result of difficulty in stone localization of a radiolucent stone (Uric acid stone) [Table 4]. This was at the initial stages of the learning curve of PCNL. Simultaneous use of the ureteroscopy was indicated in a few as a result of stones impacted in the upper ureter. In the prone group this had to be done after changing the position from prone to supine while in the supine group (including mini PCNL group) it was done in the same position. The mean operative time was significantly lower in the supine group compared to prone group. However the operative times were longer in the mini-PCNL group than supine-PCNL group because the smaller sheath took considerable time to break the stones into smaller fragments to be extracted through the smaller tract. Stone free rate was highest in the supine group, but this was not statistically significant when compared with other groups. Overall stone free rate was 84%. Stone free rate was defined as absence or <4mm stone fragments on CT KUB or X Ray KUB when indicated. Mean hospital stay was 4 days while the mean time for stent removal was 33 days overall for the study group. There was no difference between the two groups.

Fever more than 38°C was observed in 21 patients of whom 18 patients had high fever continued for more than 24 hours [Table 5]. Patients with transient fever were managed with continued IV antibiotics. Those eighteen patients with prolonged fevers had the nephrostomy tube unclamped and

Table 1. Patient characteristics						
	Prone PCNL	Supine PCNL	Mini PCNL	Total	P value	
Patient number	70	72	72	214		
Males	48(68.5%)	46(63.8%)	52(72.2%)	146(58.2%)		
Females	22(31.5%)	26(26.2%)	20(27.8%)	68 (31.8%)		
Mean Age	48.1±11.8	49.7±12.3	47.8±12.4	49±12.5	0.4	
Age range	24-74	25-75	26-70	24-75		
ASA status						
I	29(41.5%)	32(44.5%)	34(47.2%)	95(44.3%)	1	
II	41(58.5%)	40(55.5%)	38(52.8%)	119(55.7%)		
Co-Morbidity status						
Diabetes mellitus(DM)	18(25%)	23(31%)	26(36%)	67(31.3%)	0.2	
Hypertension	11(15%)	21(27%)	14(18%)	46(21.4%)		
Ischemic Heart Disease	5(7%)	4(5%)	3(4%)	12(5.6%)		
Dyslipidemia	10(14%)	9(12%)	14(18%)	33(15.4%)		
Chronic Kidney Disease II	10(14%)	9(12%)	7(9%)	26(7.4%)		
Chronic Kidney Disease III	4(5%)	4(5%)	2(3%)	10(4.6%)		
Body Mass Index kg/m²						
Overall mean BMI	26.27±3.9	25.72±3.5	25.74±3.86	25.74±3.86		0.33
BMI range	17.09-36.08	17.7-33.0	16.8-39.07	16.8-39.07		
<18.5(underweight)	3(4%)	1(1.5%)	1(1.5%)	5(2.3%)		
18.5-24.9(normal weight)	30(42%)	32(44%)	38(52%)	100(46.7%)		
25 - 29.9(over weight)	28(38%)	31(43%)	27(37%)	86(40.1%)		
30-34.9(Obesity II)	9(12%)	8(11%)	5 (8%)	22(10.2%)		
>35-39.9(Obesity II)	1(1.5%)	0	1(1.5%)	2(0.9%)		

left insitu with continued IV antibiotics until the fever settled. Transient perinephrostomy leak was observed in 21 patients who required unclamping of the nephrostomy tube for 24 hours. Eighteen patients especially in the CKD group had transient rise in their serum creatinine >0.5mg/dl or greater immediate postoperatively which normalized by six weeks. Blood transfusion were required in 7 patients.

Two patients in the prone group developed pneumonia and three patients developed urosepsis all of which was managed with IV antibiotics and supportive therapy. Two patients had superficial surgical site wound infections where the sutures had to be released. Two patients developed secondary hemorrhage and clot retention which was managed conservatively. Collecting system perforation was noted in five patients at the time of surgery, required slightly longer indwelling time of the double J stents and the open nephrostomy tubes.

There were no arterioveous fistula formation nor termination of the procedure due to bleeding. There were no damaged adjacent viscera including colonic injury or diaphragmatic injury resulting in pneumothorax, all of which have being reported in the literature. There was no renal loss or mortality reported.

Discussion

Transforming from open renal surgery to PCNL clearly has shown many advantages. A traditional open nephrolithotomy or a pyelolithotomy is performed commonly through an extra peritoneal flank incision. This requires a muscle cutting long incision, which leaves behind a formidable wound. There is no doubt that this is one of the main disincentives where patients may express concerns about wound pain predominantly due to muscle damage, increased use of analgesics, poor cosmetic results and the need for a prolonged

	Prone PCNL	Supine PCNL	Mini PCNL	Total	P value
Laterality of stones					
Right Kidney	30(42%)	35(48%)	34(46%)	99	0.3
Left Kidney	40(58%)	37(52%)	38(54%)	115	
Guys Score for renal stones					
I - solitary stone mid/lower pole	12	9	12	91(42.5%)	0.2
I - solitary pelvic	16	23	19		
II -solitary stone upper pole	2	1	3	90(42.1%)	0.2
II- multiple stones	24	22	32		
III - partial staghorn	12	8	3	25(11.6%)	
III - Stone in abnormal anatomy	0	1	1		
IV - complete staghorn	0	0	0	0	
Ureteric stones	4	2	2	8(3.7%)	
Stone density in HU units	1071(476-1582)	1130(451-1529)	1042(505-1485)	1073(451-1582)	0.21
Index stone size				26.93(13-51mm)	
10- 20 mm	18	15	16	47(21.9%)	0.88
21-30mm	44	41	54	139(64.9%)	
31-40mm	6	11	2	19(8.8%)	
>40mm	2	5	0	7(3.2%)	
Stone Composition					
Calcium oxalate	46	47	50	153(71.4%)	
Uric Acid	6	9	11	26	
Calcium oxalate + uric acid	0	2	2	4	

	Prone PCNL	Supine PCNL	Mini PCNL	Total	P value
Calyx puncture					
upper pole	3(4.2%)	1(1.3%)	2(2.6%)	4	0.8
mid pole	7(10%)	5(8.4%)	7(13.8%)	16	
lower pole	60(94.8%)	63(83.6%)	63(83.6%)	194(90.6%)	
Rib puncture – relationship to the 12th rib					
supracostal	2(2.8%)	0	0	2	1
subcostal	68(97%)	70(100%)	70(100%)	212	

recovery period in the hospital, at home and at work. When we transformed to PCNL, from open surgery we observed that most patients returned to normal activities such as driving, exercising, and sexual activity much more earlier. These were the observations made during the initial period of the study when PCNL was performed in the prone position (control group).

Once supine PCNL commenced there were many advantages

experienced during the study, including benefits to the patient, anesthetist and the surgeon.

Firstly, there is was less patient handling. Rolling the patient from supine to prone and back to supine position safely in the classical prone PCNL need minimum of 5 people including the anesthetist in the OT room. Also, it is anesthetic concern of tracheal tube dislodgment, close monitoring in compromised cardio respiratory patients and the potential for pressure point

damage, once a patient is positioned in prone. All this can be avoided in Supine PCNL.

Secondly the surgeon has the ability to perform antegrade and retrograde access to the kidney simultaneously giving the opportunity to achieve better stone clearance by dealing with upper ureteric and other calyceal stones.

Also, better drainage via the Amplatz sheath by using gravity enables the stone fragments to clear easily. This was an observation made where the stone free rate was much higher in the supine group when compared to the prone group.

Lateral approach of the technique enables less radiation exposure to the surgeon's hand. Also, laterally place nephrostomy tube enables the patient to have comfortable seating and sound sleep while lying on the back immediately post op unlike in the prone position where the tube is placed on the back. Moreover, it is greater comfort to the surgeon since the surgery can be performed in the sitting position.

Despite several advantages in performing supine PCNL, there are few drawbacks experienced with the supine technique. The puncture route is slightly longer when compared to prone position. There is medial displacement of the kidney with the

	Prone PCNL	Supine PCNL	Mini PCNL	Total	P value
Procedure completed	68	70	72	210	
Conversion to open surgery	2	0	0	2	
Simultaneous use of URS	2	7	11	20	
Operative time(min)	119±40	97±42	104±38	107±42	0.04*(gp 1 and 2)
Mean nephrostomy time(days)	2	2.3	2	2.3	
Hospital stay(days)	4.1±0.7	4.3±0.8	4±0.8	4.2±0.7	
Stone free rate	55(78%)	66(91.6%)	59(82%)	180(84.1%)	0.1
Time for DJ stent removal(days)	32	36	30	33	
Post procedure fURS	3	4	2	9	

Grade	Complication	Prone PCNL	Supine PCNL	Mini PCNL	Total	Significance
I	Fever >38 °C lasting for more than 24hrs	10	3	5	18	p=0.3
	Perinephrostomy leak	10	7	4	21	p=0.7
	Transient rise of creatinine >0.5mg/dl	3	8	7	18	p=0.1
II	Blood transfusion	4	2	1	7	
	Urosepsis	2	3	4	9	
	Pneumonia	2	0	0	2	
III A	Acute Retention due to blood clots	1	1	2	4	
	Angio-embolization of AV fistula	0	0	0	0	
	DJ stent dislodgment requiring repositioning	0	2	0	2	
III B	Infundibular stricture	0	1	0	1	
	Collecting system perforation	3	1	3	7	
IV A	Visceral injury	0	0	0	0	
	Nephrectomy	0	0	0	0	
IV B	Multi organ dysfunction (MODS)	0	0	0	0	
V	Death	0	0	0	0	

puncture. But this can be used to advantage as guide to locate the surface of the kidney when the medial displacement is noticed when needle hits the surface of the kidney.

With these advantages, the study was extended where miniaturizing the technique where a smaller renal track was created to deal with renal stone (mini PCNL). The observations made during the mini PCNL group was that the procedure can achieve comparable stone-free rates to the conventional methods, even for large stones. It is a safe procedure, and no major complications are reported. Although less invasive it failed to demonstrate a clear advantage in terms of transfusion rates or shorter hospital stay than the standard method. However it was clear that mini PCNL tract can be useful as a multi tract procedure in order to achieve complete stone clearance of a staghorn calculi or large renal stone burden situation.

The strength of the entire study is that it was a single center study with the same urological team with single surgeon performing all cases unlike in most of other large series where many surgeons are involved.

As an endourologist it is of paramount importance to change your practice according to the best available evidence and adhere to the technique which you are most conversant with. This will ensure patient safety, and better outcomes with ease and comfort not only to the practicing surgeon but to the entire surgical team which includes the anesthetist, nurses and minor staff members.

Present study clearly demonstrated that supine PCNL was statistically equally effective, showing slightly increased though statistically non-significant rate of stone clearance in comparison to the prone approach.

None of the patients in the study experienced major complications such as death, renal loss, major haemorrhages, arteriovenous fistula requiring embolization, pleural and colonic injury which are reported in previous larger studies [17]. The minor complications the patients had completely resolved with time. This confirms that the supine PCNL as well as mini PCNL was equally or much safer when compared to the traditional technique.

More importantly the operating time was significantly lower in the supine group. This has had the greatest impact in changing our practice to shift from prone to supine PCNL.

In brief PCNL in supine position is as effective and safe as PCNL in the prone position and has proven to be a better alternative to the traditional prone PCNL in our setup. Mini PCNL will be useful when the stone burden is small or as a second tract or as multi-tracts when dealing with a large stone

burden.

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.

References

1. Lopez A D, Williams T N, Levin A, et al. Remembering the forgotten non-communicable diseases. *BMC Med.* 2014;12:200. <https://doi.org/10.1186/s12916-014-0200-8>
2. Parmar M S. Kidney stones. *BMJ.* 2004; 328 (7453): 1420-4. <https://doi.org/10.1136/bmj.328.7453.1420>
3. Tefekli A, Cezayirli F. The history of urinary stones: in parallel with civilization. *ScientificWorldJournal.* 2013;2013:423964. <http://dx.doi.org/10.1155/2013/423964>
4. Khalili M, Wong RJ. Underserved Does Not Mean Undeserved: Unfurling the HCV Care in the Safety Net. *Dig Dis Sci.* 2018;63(12):3250-3252. https://doi.org/10.1007/978-3-642-95390-3_1
5. Albala DM, Assimos DG, Clayman RV et al. Lower pole I: a prospective randomized trial of extracorporeal shock wave lithotripsy and percutaneous nephrostolithotomy for lower pole nephrolithiasis-initial results. *J Urol.* 2001 Dec;166(6):2072-80 [https://doi.org/10.1016/S0022-5347\(05\)65508-5](https://doi.org/10.1016/S0022-5347(05)65508-5)
6. Donaldson JF, Lardas M, Scrimgeour D, et al. Systematic review and meta-analysis of the clinical effectiveness of shock wave lithotripsy, retrograde intrarenal surgery, and percutaneous nephrolithotomy for lower-pole renal stones. *Eur Urol.* 2015;67(4):612-6. <https://doi.org/10.1016/j.eururo.2014.09.054>
7. Sudah M. Re: Christian Türk, Aleš Petřík, Kemal Sarica, et al. EAU Guidelines on Diagnosis and Conservative Management of Urolithiasis. *Eur Urol* 2016;69:468-74: Magnetic Resonance Urography Can be Used to Detect Urinary Stones. *Eur Urol.* 2016;69(4):e76-e77. <https://doi.org/10.1016/j.eururo.2015.11.009>
8. Malik I, Wadhwa R. Percutaneous Nephrolithotomy: Current Clinical Opinions and Anesthesiologists Perspective. *Anesthesiol Res Pract.* 2016;2016:9036872. <http://dx.doi.org/10.1155/2016/9036872>
9. Edgcombe H, Carter K, Yarrow S. Anaesthesia in the prone position. *Br J Anaesth.* 2008;100(2):165-83. <https://doi.org/10.1093/bja/aem380>
10. Miano R, Scoffone C, De nunzio C, et al. Position: prone or supine is the issue of percutaneous nephrolithotomy. *J Endourol.* 2010;24(6):931-8. <https://doi.org/10.1089/end.2009.0571>
11. Atkinson CJ, Turney BW, Noble JG, Reynard JM, Stoneham MD. Supine vs prone percutaneous nephrolithotomy: an anaesthetist's view. *BJU Int.* 2011;108(3):306-8. <https://doi.org/10.1111/j.1464-410X.2011.10488.x>
12. Valdivia Uría JG, Valle Gerhold J et al. Technique and complications of percutaneous nephroscopy: experience with 557 patients in the supine position. *J Urol.* 1998;160(6 Pt 1):1975-1978. [https://doi.org/10.1016/S0022-5347\(01\)62217-1](https://doi.org/10.1016/S0022-5347(01)62217-1)
13. Valdivia JG, Scarpa RM, Duvdevani M, et al. Supine versus prone position during percutaneous nephrolithotomy: a report

- from the clinical research office of the endourological society percutaneous nephrolithotomy global study. *J Endourol.* 2011;25(10):1619-25. <https://doi.org/10.1089/end.2011.0110>
14. Bach C, Goyal A, Kumar P, et al. The Barts 'flank-free' modified supine position for percutaneous nephrolithotomy. *Urol Int.* 2012;89(3):365-8. <https://doi.org/10.1159/000341430>
 15. Ferakis N, Stavropoulos M. Mini percutaneous nephrolithotomy in the treatment of renal and upper ureteral stones: Lessons learned from a review of the literature. *Urol Ann.* 2015;7(2):141-8. <https://dx.doi.org/10.4103%2F0974-7796.152927>
 16. Thomas K, Smith NC, Hegarty N, Glass JM. The Guy's stone score--grading the complexity of percutaneous nephrolithotomy procedures. *Urology.* 2011;78(2):277-81. <https://dx.doi.org/10.1016/j.urology.2010.12.026>
 17. Taylor E, Miller J, Chi T, Stoller ML. Complications associated with percutaneous nephrolithotomy. *Transl Androl Urol.* 2012;1(4):223-8. <https://dx.doi.org/10.3978%2Fj.issn.2223-4683.2012.12.01>
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Sri Lanka guidelines for the management of hepatic metastases from colorectal cancer

A Joint initiative of the Sri Lanka National Chapter of the International Hepato-Pancreato-Biliary Association (SLHPBA) and the International Hepato-Pancreato-Biliary Association (IHPBA)

Dharmapala AD¹, Siriwardena RC², Chan A³, Adair A⁴, Shrikhande S⁵, Jeyarajah R⁶, Jegatheeswaran S³, Jagannath P⁷, Siriwardhane M⁸, Sivaganesh S⁹, Pathirana AA¹⁰, Siriwardena AK³

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

² Department of Surgery, University of Kelaniya, Ragama, Sri Lanka

³ Regional HPB Unit, Manchester Royal Infirmary, Manchester, UK

⁴ Department of Transplant Surgery, Edinburgh Royal Infirmary, Edinburgh, UK

⁵ Department of Surgical Oncology, Tata Memorial Hospital, Mumbai, India

⁶ Methodist Dallas Medical Center, Texas, USA

⁷ Lilavati Hospital & Research Centre, Mumbai, India

⁸ Mater Hospital, Raymond Terrace, South Brisbane, Queensland, Australia 4101

⁹ Department of Surgery, University of Colombo, Colombo, Sri Lanka

¹⁰ Department of Surgery, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

Key words: Hepatic metastases; colorectal cancer

Abstract

Guidelines to manage liver metastases were developed at a meeting jointly organized by the Sri Lanka Hepato Pancreato Biliary Association (SLHPBA) and the International Hepato Pancreato Biliary Association (IHPBA). Existing evidence was used in the development of guidelines, as recommended by the AGREE II consortium. Guidelines are provided for diagnosis, pre-operative workup, multi-disciplinary team review, surgery, anaesthesia, post-operative care and follow up. Consideration was given to the limitations of facilities available in the country.

Introduction

Liver resection is indicated in carefully selected patients with hepatic metastases from colorectal cancer [1]. As hepatic surgery has developed as a subspecialty, the skills and expertise required to undertake liver resection and to provide peri-operative care for these patients, have become more widely available. There is good evidence that this type of complex surgery should be concentrated in specialist units. In the current era, clinical decision making should be formulated in a multidisciplinary team.

The collaboration between the Sri Lanka National Chapter of the International Hepato-Pancreato-Biliary Association

(SLHPBA) and the International Hepato-Pancreato-Biliary Association (IHPBA) started in 2015 and at the last meeting held in Colombo in August 2017, a full day was dedicated to the production of multidisciplinary, disease-specific guidelines. This process led to the publication of the Sri Lanka guidelines for the diagnosis and management of acute pancreatitis [3] and management of hepatocellular carcinoma [4]. As the 2012 revision of the Atlanta consensus document [5] on which the Sri Lanka pancreatitis guidelines were based provides an international reference standard, the process of adapting guidelines was relatively straightforward. There are no similar, universally accepted international guidelines for the management of liver metastases from colorectal cancer. Thus, the aim of this document is to utilise the approach recommended by the AGREE (Appraisal of Guidelines for Research and Evaluation) consortium [6] to adapt international guidelines to Sri Lanka.

The objectives of this guideline are to provide contemporary and practical advice for the management of patients with liver metastases from colorectal cancer within the healthcare system of Sri Lanka.

Methods

Adapting existing evidence.


Aspects of the approach recommended by the AGREE II consortium was adopted [6].

The AGREE II consortium describes a practical method for clinicians to adopt existing evidence and to synthesise guidelines.

Correspondence: Professor Aloka Pathirana

E-mail: alokpathi@gmail.com

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 <http://orcid.org/0000-0002-8608-7770>

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This document uses the following domains of the AGREE II guideline:

1. The scope and purpose of the guideline should be clearly defined.
2. The guideline should involve all stakeholder groups: surgeons, oncologists, radiologists and others with a relevant interest.
3. The guideline should be developed systematically.
4. The guideline should be presented clearly.
5. The guideline should be of practical value.

Guideline development meeting of the SLHPBA/IHPBA global outreach team

The meeting was attended by surgeons, oncologists, pathologists and radiologists from Sri Lanka. The IHPBA team was composed of surgeons from the United Kingdom, the United States of America, India and Australia. The outline presentation on colorectal liver metastases was given by Dr Arinda Dharmapala.

Subsequently, international guidelines from the United States of America [7], the United Kingdom [8], Europe [9] and Japan [10] were reviewed in detail and a draft discussion document was synthesised by Professor Ajith Siriwardena and has been modified over a series of discussions with all stakeholders and co-authors.

The final guidance is given below.

SRI LANKA GUIDELINES

1. Diagnosis of hepatic metastases

1.1 Imaging

- Imaging for staging of patients with liver metastases from colorectal cancer should include contrast-enhanced triple-phase computed tomography (CT) of the thorax, abdomen and pelvis.
- Contrast-enhanced magnetic resonance (MR) scanning of the liver provides additional information and is also recommended [11].
- MR imaging should be undertaken at baseline and before chemotherapy, when available.
- ¹⁸F-fluorodeoxyglucose positron emission scanning (FDG-PET) is not routinely available in Sri Lanka at the time of production of this guideline. A large randomised trial has demonstrated no additional survival benefit from the use of FDG-PET as an additional test and thus FDG-PET is NOT recommended [12].

1.2 Blood Tests

- Baseline blood tests should include full blood count, coagulation profile, urea and electrolytes and enzymatic

liver function tests.

- CEA (carcino embryonic antigen) level is useful in follow-up and in assessing response to treatment and should be considered if available [13].

1.3 Genetic Testing

- Genetic testing for mutations of the K-ras (Kirsten Rat Sarcoma virus) gene is not widely available. If available, K-ras mutation testing is useful in assessing whether to prescribe biologic chemotherapy agents aimed at inhibiting the EGFR (Epidermal Growth Factor Receptor) pathway [14]. Patients who carry mutations of K-ras are resistant to EGFR-inhibitor therapy [15].

2. Pre-operative work-up

2.1 Assessment of cardiac and respiratory fitness for surgery

- In addition to a detailed clinical history and physical examination together with a record of co-morbidities and medication, baseline tests should include a 12-lead electrocardiogram and in those individuals with respiratory disease, pulmonary function tests.

2.2 Pre-operative risk scores

- The revised cardiac risk index or the New York Heart Association Functional Class (NYHA) [16] may provide additional information in pre-operative risk assessment.

3. Multidisciplinary team case review

3.1 Composition

- The multidisciplinary team (MDT) should have representation from all groups involved in the care of patients with metastatic colorectal cancer. The core group should include liver and colorectal surgeons, clinical oncologists, radiologists, pathologists and specialist nurses.

4. Surgery

4.1 Treatment goal of liver resection for colorectal hepatic metastases

- Hepatic resection is the treatment of choice for resectable liver metastases.
- Complete resection must be feasible based on anatomical grounds and the extent of disease, with maintenance of adequate hepatic function.

4.2 Liver resection in the presence of extrahepatic metastases

- Hepatic resection should not generally be undertaken in the presence of extra-hepatic disease. There may be exceptions to this rule: for example, liver surgery may be considered in patients with small volume, stable lung lesion(s) or in those patients with a solitary lung lesion amenable to resection/ablation or external radiotherapy.

- It should be remembered that the evidence-base for surgical resection of lung metastases from colorectal cancer is very limited.

4.3 Modern terminology of liver resections

- Modern terminology for liver resection uses the terminology outlined in the Brisbane consensus conference and illustrated in a subsequent review article [1].

4.4 Extent of safe liver resection

- The principle of safe liver surgery is to ensure adequate inflow, outflow and biliary drainage of the future remnant liver. Thus, a resection of up to 70% of the liver parenchyma in the form of a right trisection-ectomy or left trisectionectomy can be undertaken.
- The extent of safe resection is reduced by patient factors such as cirrhosis, fatty liver, non-alcoholic fatty liver disease (NAFLD) and increasing age. The extent of safe resection is also reduced by prior chemotherapy. If CT volumetry is available, it should be utilised in resection planning to assess safe future remnant liver.
- If the future remnant liver (FRL) is likely to be too small, portal vein ligation or percutaneous embolization of the portal vein (PVE) – typically the right portal vein – will produce compensatory hypertrophy of the left lobe. In patients undergoing modification of the FRL, baseline CT and follow-up CT at around 4 to 6 weeks should be undertaken.

4.5 Use of prognostic scores to determine whether to offer resection

- It is accepted that the number of liver metastases does not determine resectability. However, prognostic scores such as that developed by Memorial Sloan-Kettering Hospital indicate that patients with more than 5 liver metastases with the largest being >5 cm in size, and present within 12 months of presentation of the primary, together with a node positive tumour and high CEA have a high risk of early recurrence [17].

4.6 Anaesthesia and preparation for liver surgery

- Patients should have blood cross-matched and available in theatre.
- Peri-operative analgesia can be provided by epidural catheters although there is recent evidence that wound catheters are also effective [18].
- Intra-operative monitoring requires invasive arterial display of heart rate and blood pressure.
- Central venous pressure should be monitored and should be maintained at a low level during liver transection by avoidance of excessive infusion of intravenous fluid.

4.7 Liver transection

- It is recommended practice to use intra-operative ultrasonography to confirm the distribution of liver lesions and to confirm that the future remnant liver is disease-free.
- There is a very wide range of liver transection equipment. There is no evidence of superiority for any particular device [19].
- Current evidence suggests that the laparoscopic approach should be offered for patients requiring left lateral sectionectomy [20]. Other resections can be undertaken laparoscopically following the same principles of open liver surgery [21].

4.8 Post-operative care after liver resection.

- Patients should be nursed in a high-dependency unit after surgery with 1:1 nursing care and facilities for inotropic support and non-invasive ventilator support.
- If a surgical drain is used the drain bilirubin should be measured on the 3rd post-operative day.
- The terminology for reporting of complications recommended by the International Study Group for Liver Surgery (ISGLS) should be used [22-24].

5. Chemotherapy

- A detailed discussion of chemotherapy is beyond the scope of these guidelines.
- The EORTC 40983 study showed that in patients with up to four metachronous liver metastases, treatment with pre- and post-operative oxaliplatin produced no improvement in 5-year survival compared to surgical resection alone. However, an increase in progression free survival was noted compared with surgery alone [25].
- This study showed no additional morbidity in patients having liver resection after chemotherapy but it should be emphasised that the amount of pre-operative chemotherapy was relatively limited.
- Current evidence indicates that either an oxaliplatin-based or an irinotecan-based chemotherapy backbone can be utilised as first line care in either the neo-adjuvant or adjuvant setting.
- The New-EPOC trial showed no additional survival benefit from adding cetuximab to these chemotherapy regimens although it is now known that cetuximab is only effective in patients who do not carry mutations of K-ras or B-raf [14].

6. Follow-up

6.1 Surveillance

- Outpatient follow-up (history and examination) every 6 months for 5 years.

- CEA at each outpatient appointment
- CT thorax / abdomen / pelvis every 6 months for 2 years, then annually till 5 years.
- Ensure completion colonoscopy.
- Colonoscopy at 1 year.

7. Newer treatments for colorectal hepatic metastases.

7.1 Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy (ALPPS)

- ALPPS is a recognised technique for treatment of hepatic metastases when there is insufficient tumour-free parenchyma to sustain a one-stage resection.
- Although established and supported by an international registry the recent LIGRO randomized trial of ALPPS versus two-stage hepatectomy showed an 8% mortality associated with ALPPS [26].
- If ALPPS is to be considered, it is recommended that units join the international ALPPS registry.
- At the time of writing of these guidelines, ALPPS remains a technique to be viewed with caution and is as yet unestablished in mainstream liver surgical practice.

7.2 Ablation of liver tumours

- Although not strictly a “newer” technique, technical and equipment developments have made ablation a treatment option that may be utilised.
- Ablation involves destruction of liver tumours either by using thermal energy (radiofrequency ablation, microwave ablation) or by using electrical energy to cause cellular destruction (irreversible electroporation - IRE).
- Cryotherapy is no longer utilised for the treatment of colorectal hepatic metastases.
- There is some evidence that ablation can be effective and it may be used in conjunction with resection.
- Advantages of ablation are that it can be used percutaneously. Ablation is currently not a preferred treatment for colorectal hepatic metastases because of the relatively high risk of recurrence.

8. Treatments of no proven benefit for colorectal hepatic metastases

8.1 Selective Internal Radiation Therapy (SIRT)

- SIRT involves the angiographic delivery of beads or microparticles incorporating the radio-isotope Yttrium-90 to liver tumours.
- Although initially thought to be promising, the pooled analysis of three world-wide randomised trials has shown no evidence of survival benefit [27].
- A valid criticism of these studies was the high proportion of patients with extra-hepatic disease who were subjected to SIRT.

- However, even in the subgroup of patients with liver-limited hepatic metastases treated by SIRT there was neither evidence of survival benefit nor a higher conversion to resection.
- SIRT is now regarded as a treatment of no benefit for patients with colorectal hepatic metastases.

9. Planned review of guidelines

- The SLHPBA/IHPBA will review these guidelines in 5 years.

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.

References

1. Siriwardena AK, Mason JM, Mullaitha S, Hancock HC, Jegatheeswaran S. Management of colorectal cancer presenting with synchronous liver metastases. *Nat Rev Clin Oncol* 2014; 11:446-459.
<https://doi.org/10.1038/nrclinonc.2014.90>
2. Dimick JB, Cowan JA, Jr., Knol JA, Upchurch GR, Jr. Hepatic resection in the United States: indications, outcomes, and hospital procedural volumes from a nationally representative database. *Arch Surg.* 2003;138(2):185-91.
<http://doi.org/10.1001/archsurg.138.2.185>
3. Sivaganesh S, Siriwardena A, Pathirana A. SLHPBA guidelines on the management of acute pancreatitis – a consensus document. *Sri Lanka Journal of Surgery.* 2017; 35:29-33.
<http://doi.org/10.4038/sljs.v35i4.8436>
4. Siriwardena RC, Pathirana AA, Siriwardana AK, Espat NJ, Adair A. SLHPBA Guidelines for the management of hepatocellular carcinoma in Sri Lanka – consensus statement. *Sri Lanka Journal of Surgery* 2018;36(1): 31-33.
<http://doi.org/10.4038/sljs.v36i1.8478>
5. Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, et al. Classification of acute pancreatitis--2012: revision of the Atlanta classification and definitions by international consensus. *Gut.* 2013; 62:102-111.
<http://doi.org/10.1136/gutjnl-2012-302779>
6. Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ.* 2010;182: E839-42.
<https://doi.org/10.1503/cmaj.090449>
7. National Comprehensive Cancer Network. Clinical practice guidelines in oncology. Colon Cancer. Version 3.2018. https://www.nccn.org/professionals/physician_gls/pdf/colon.pdf
8. National Institute for Health and Care Excellence. Colorectal cancer diagnosis and management. November 201. <https://www.nice.org.uk/guidance/cg131>
9. Van Cutsem E, Cervantes A, Adam R, Sobrero A, van Krieken JH, Aderka D et al. ESMO consensus guidelines for the management of patients with metastatic colorectal cancer. *Ann Oncol* 2016; 27:1386-1422.
<https://doi.org/10.1093/annonc/mdw235>
10. Watanabe T, Itabashi M, Shimada Y, Tanaka S, Ito Y, Ajioka Y et al. Japanese Society for Cancer of the Colon and Rectum (JSCCR) Guidelines 2014 for treatment of colorectal cancer. *Int J Clin Oncol* 2015 20:207–239.
<http://doi.org/10.1007/s10147-015-0801-z>

11. Blyth S, Blakeborough A, Peterson M, Cameron IC, Majeed AW. Sensitivity of magnetic resonance imaging in the detection of colorectal liver metastases. *Ann R Coll Surg Engl.* 2008; 90:25-28. <http://doi.org/10.1308/003588408X242303>
12. Moulton CA, Gu CS, Law CH, Tandan VR, Hart R, Quan D, et al. Effect of PET before liver resection on surgical management for colorectal adenocarcinoma metastases: a randomized clinical trial. *JAMA.* 2014;311(18):1863-1889. <http://doi.org/10.1001/jama.2014.3740>
13. Berman JM, Cheung RJ, Weinberg DS. Surveillance after colorectal cancer resection. *Lancet.* 2000; 355:395-399. [https://doi.org/10.1016/S0140-6736\(99\)06552-6](https://doi.org/10.1016/S0140-6736(99)06552-6)
14. Primrose J, Falk S, Finch-Jones M, Valle J, O'Reilly D, Siriwardena A, et al. Systemic chemotherapy with or without cetuximab in patients with resectable colorectal liver metastasis: The New EPOC randomised controlled trial. *Lancet Oncol.* 2014; 15:601-611. [http://doi.org/10.1016/S1470-2045\(14\)70105-6](http://doi.org/10.1016/S1470-2045(14)70105-6)
15. Misale S, Yaeger R, Hobor S, Scala E, Janakiraman M, Liska D, et al. Emergence of KRAS mutations and acquired resistance to anti-EGFR therapy in colorectal cancer. *Nature.* 2012; 486:532-536. <http://doi.org/10.1038/nature11156>
16. The Criteria Committee of the New York Heart Association. Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Great Vessels. 9th ed. Boston, Mass: Little, Brown & Co; 1994:253-256. <https://trove.nla.gov.au/version/13288061>
17. Fong Y, Fortner J, Sun RL, Brennan MF, Blumgart LH. Clinical Score for Predicting Recurrence After Hepatic Resection for Metastatic Colorectal Cancer Analysis of 1001 Consecutive Cases. *Ann Surg* 1999; 230:309-321. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1420876/>
18. Revie EJ, McKeown DW, Wilson JA, Garden OJ, Wigmore SJ. Randomized clinical trial of local infiltration plus patient-controlled opiate analgesia vs. epidural analgesia following liver resection surgery. *HPB (Oxford).* 2012; 14:611-618. <http://doi.org/10.1111/j.1477-2574.2012.00490.x>
19. Appéré F, Piardi T, Memeo R, Lardièrre-Deguelte S, Chetboun M, Sommacale D, Pessaux P, Kianmanesh R. Comparative Study with Propensity Score Matching Analysis of Two Different Methods of Transection During Hemi-Right Hepatectomy: Ultracision Harmonic Scalpel Versus Cavitron Ultrasonic Surgical Aspirator. *Surg Innov* 2017; 24:499-508. <http://doi.org/10.1177/1553350617723269>
20. Chang S, Laurent A, Tayar C, Karoui M, Cherqui D. Laparoscopy as a routine approach for left lateral sectionectomy. *Br J Surg* 2007; 94:58-63. <https://www.ncbi.nlm.nih.gov/pubmed/17054316>
21. Wakabayashi G, Cherqui D, Geller DA, Buell JF, Kaneko H, Han HS et al. Recommendations for laparoscopic liver resection. A report from the second international consensus conference held in Morioka. *Ann Surg* 2015; 261:619-629. PMID: 25742461
22. Koch M, Garden OJ, Padbury R, Rahbari NN, Adam R, Capussotti L, et al. Bile leakage after hepatobiliary and pancreatic surgery: a definition and grading of severity by the International Study Group of Liver Surgery. *Surgery.* 2011;149(5):680-688. <http://doi.org/10.1016/j.surg.2010.12.002>
23. Rahbari NN, Garden OJ, Padbury R, Brooke-Smith M, Crawford M, Adam R, et al. Posthepatectomy liver failure: a definition and grading by the International Study Group of Liver Surgery (ISGLS). *Surgery.* 2011;149(5):713-24. <http://doi.org/10.1016/j.surg.2010.10.001>
24. Rahbari NN, Garden OJ, Padbury R, Maddern G, Koch M, Hugh TJ, et al. Post-hepatectomy haemorrhage: a definition and grading by the International Study Group of Liver Surgery (ISGLS). *HPB (Oxford).* 2011;13(8):528-35. <http://doi.org/10.1111/j.1477-2574.2011.00319.x>
25. Nordlinger B, Sorbye H, Glimelius B, Poston GJ, Schlag PM, Rougier P, et al. Perioperative FOLFOX4 chemotherapy and surgery versus surgery alone for resectable liver metastases from colorectal cancer (EORTC 40983): long-term results of a randomised, controlled, phase 3 trial. *Lancet Oncol.* 2013;14(12):1208-1215. [http://doi.org/10.1016/S1470-2045\(13\)70447-9](http://doi.org/10.1016/S1470-2045(13)70447-9)
26. Sandstrom P, Rosok BI, Sparrelid E, Larsen PN, Larsson AL, Lindell G, et al. ALPPS Improves Resectability Compared with Conventional Two-stage Hepatectomy in Patients with Advanced Colorectal Liver Metastasis: Results from a Scandinavian Multicenter Randomized Controlled Trial (LIGRO Trial). *Ann Surg.* 2018; 267:833-840. PMID- 28902669. <http://doi.org/10.1097/SLA.0000000000002511>
27. Wasan HS, Gibbs P, Sharma NK, Taieb J, Heinemann V, Ricke J, et al. First-line selective internal radiotherapy plus chemotherapy versus chemotherapy alone in patients with liver metastases from colorectal cancer (FOXFIRE, SIRFLOX, and FOXFIRE-Global): a combined analysis of three multicenter, randomised, phase 3 trials. *Lancet Oncol.* 2017; 18:1159-1171. [http://doi.org/10.1016/S1470-2045\(17\)30457-6](http://doi.org/10.1016/S1470-2045(17)30457-6)

Management of axilla in breast cancer: the past, present and the future

Oshan Basnayake¹, Umesh Jayarajah¹, Sanjeewa Seneviratne²

¹Professorial Surgical Unit, National Hospital of Sri Lanka, Colombo, Sri Lanka

²Department of Surgery, Faculty of Medicine, University of Colombo, Sri Lanka

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Abstract

The role of surgery in treatment of breast cancer has evolved substantially during the last century where radical surgery has gradually been replaced by more conservative approaches. Similarly, surgical treatment of the axilla has changed rapidly especially over last three decades. This is mostly as a result of improvements in understanding of disease behaviour and advances in systemic therapy. Axillary surgery has the dual uses of removing the disease from the axilla and providing information for prognostication which help guide adjuvant therapy. However, surgery to the axilla is associated with substantial morbidity including lymphedema and shoulder stiffness. Hence, less radical approaches for the treatment of the axilla have been of interest.

The traditional gold standard of axillary lymph node dissection was challenged by many clinical trials. As result sentinel lymph node biopsy was introduced as an alternative for patients with clinically negative axillae which later became the standard of care for such patients. Subsequent studies proved the safety of omitting completion axillary dissection or replacing with radiotherapy for selected patients with minimal sentinel lymph node involvement.

The application of sentinel lymph node biopsy for axillary staging after neoadjuvant chemotherapy has become an area of clinical interest. However, sentinel lymph node biopsy in node-positive patients who become node negative after neoadjuvant chemotherapy is controversial at present due to the relatively high false-negative rate. This however, is improved by careful patient selection combined with some minor changes to the surgical technique of sentinel lymph node biopsy.

Novel techniques for lymphatic mapping have shown promising results which further simplify the procedure while improving the accuracy. Axillary reverse mapping, a technique to preserve lymph nodes draining the arm during axillary surgery for breast cancer has been described recently which has further reduced surgical morbidity. The omission of axillary surgery in selected patients with an acceptably low risk of nodal metastasis has gained increasing research interest in the recent past. Furthermore, advances in treatment and newer prognostication techniques have reduced the dependence on axillary nodal status on adjuvant therapy decision-making. This has led to several ongoing clinical trials which will assess the feasibility of avoiding sentinel lymph node biopsy altogether in selected groups of patients without compromising outcomes.

Introduction

Breast cancer is the most common female cancer worldwide including both developing and developed countries [1]. In Sri Lanka, breast cancer has become the commonest cancer and a continuous increase in the incidence is observed [1]. Treatment of breast cancer initially was based on management of primary cancer and the adjacent region; the breast and the axilla. This however has changed dramatically with the advent of systemic therapy which not only has led to major improvements in survival but also less radical surgery [2]. The role of surgery in the management of the axilla especially in patients with early-stage breast cancer has evolved in the past few decades with the improvement in the understanding of the disease together with advances in systemic therapy. This review focuses on the evolution of the surgical management of axilla in breast cancer and summarises the current evidence on sentinel lymph node biopsy (SLNB) in early breast cancer patients, novel techniques for SLNB, and the ongoing clinical trials on management of axilla in breast cancer.


Evolution of breast cancer surgery

The history of management of breast cancer goes back to early 1800s. Rudolf Virchow (1821–1902), a German pathologist postulated a hypothesis based on his autopsy studies that there was evidence of axillary lymph node (ALN) involvement in females who died from advanced disease[3]. Local invasion of cancer with progressive spread to regional

Correspondence: Sanjeewa Seneviratne

E-mail: sanjeewa@srg.cmb.ac.lk

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 <http://orcid.org/0000-0003-0310-1387>

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and distant structures were key components of his hypothesis. Based on these findings, William Halsted (1852–1922) introduced radical mastectomy which comprised of a radical resection of breast with pectoralis major and minor muscles together with ALNs as en bloc [4]. David Patey in 1940s introduced modified radical mastectomy which preserved pectoralis major muscle to reduce surgical morbidity without compromising on overall survival [5]. Later, Madden and Auchincloss showed that the pectoralis minor muscle can also be preserved while achieving a ALN clearance with comparable outcomes [6]. With better understanding of the pathogenesis of the disease and advances of local and systemic adjuvant treatment, the concept of radical surgery was disputed and breast conservative surgery became the standard of care where feasible. The simple mastectomy was first developed by Kennedy and Miller [7]. In 1991, Toth and Lappert described skin sparing mastectomy which allowed breast reconstructions with improved cosmetic outcomes [8].

Management of ALNs has been a cornerstone in patients with breast cancer. It helps with regional disease control and provides valuable information for prognostication and for decisions on adjuvant therapy. Axillary lymph node dissection (ALND) remained as the method of axillary staging and routine ALND was the gold standard of managing the axilla until the 1970s, despite the surgical morbidity related to the procedure. This practice started to change after the which National Surgical Adjuvant Breast and Bowel Project (NSABP) trial B-04 disputed the value of ALND in patient without any clinical evidence of axillary metastasis as approximately 40% of patients undergoing ALND had negative nodal involvement [9]. This proportion increased further with the introduction of mammographic breast cancer screening in 1980s, which led to a rise in early breast cancers. As a result, many researches were conducted to study the usefulness of ALND in such patients with early stage disease with no clinical involvement of the ALNs.

Axillary staging with sentinel lymph node biopsy in breast cancer

Axillary lymph node staging in patients with breast cancer is initially performed with physical examination of regional nodes. However, this is influenced by body habitus and thus has an approximately 50% false-negative rate (FNR) [10]. Therefore, ultrasonography is the preferred modality for nodal assessment. Additional advantages of ultrasonography include the ability to obtain guided needle biopsies to allow pathological assessment of suspicious nodes. However, to date no imaging modality has been accurate enough to accurately stage the axilla especially when the nodal burden is minimal.

The concept of SLN is based on the principle of lymphatic drainage from the breast to regional lymph nodes which follows an orderly pattern initially reaching a node or few

nodes known as the sentinel lymph nodes (SLN). Initial understanding of different sentinel node groups depending on the site of the tumour was challenged by the subsequent studies which showed that all lymph drains into the same sentinel nodes through the subareolar lymphatic plexus of Sappey [11]. Further studies have shown that periareolar or intradermal injections of mapping agents are equivalent or superior to peritumoural injections [12]. Although internal mammary nodes can drain the deep retromammary areas, the risk of involvement without axillary nodal involvement is minimal and hence isolated or initial internal mammary nodal recurrences remains very low [13].

SLNs are harvested using different techniques which commonly include a blue coloured dye (methylene blue or isosulphan blue) or a radioactive technetium 99m-labelled colloid. Detection rate for SLNs are approximately 90% with the blue dye and >95% when combined with a radioactive tracer [14]. Novel techniques for detection of SLN include indocyanine green fluorescence, contrast-enhanced ultrasound using micro bubbles and superparamagnetic iron oxide nanoparticles which however are not widely practised yet. A recent systematic review has shown that these newer methods to be comparable to existing techniques in relation to detection rates [14].

Management of clinically negative axilla

Sentinel lymph node biopsy vs. axillary lymph node dissection for axillary staging

Due to the associated surgical morbidity, ALND was a major concern in patients with negative axillary nodes. NSABP B-32 trial was conducted with the objectives of determining the value of SLNB in regional control and overall survival compared with ALND in resectable breast cancers with clinically negative axillae [15]. This randomized phase three multicentre clinical trial randomly assigned 5611 to SLNB plus ALND or SLNB alone with ALND only if sentinel nodes were positive. Identification of SLN was done with a combination of radiocolloid and isosulfan blue dye. SLN identification rate was 97.2% with a FNR of 9.8%. After a median follow up of nearly 8 years no significant differences were observed in disease-free survival (hazard ratio [HR] 1.05, p=0.54) or overall survival (HR: 1.20, p=0.12) between the two groups. A substantial reduction in surgical morbidity was noted in SLNB alone group in terms of shoulder stiffness, lymphedema and upper limb numbness. Similar results were obtained from ALMANAC and Milan trials [16, 17]. Based on these studies, SLNB is currently considered as the standard of axillary staging in operable breast cancers with clinically negative axillae.

Positive Sentinel node biopsy – Sentinel node biopsy alone or axillary lymph node dissection?

Z0011 trial conducted by the American College of Surgeons

Oncology Group assessed impact of avoiding ALND in patients with positive SNLs on local cancer recurrence and survival [18]. This phase three non-inferiority randomized control trial included breast cancer patients with clinically negative axilla with T1-T2 cancers undergoing lumpectomy and whole breast irradiation. Patients with 1-2 sentinel nodes positive for micro or macro metastasis were randomized into ALND or no further axillary surgery. There was no significant difference in 5-year overall survival and disease-free survival between the two groups after a median follow up of over 6 years. This landmark trial findings confirmed the safety of omitting ALND in T1 or T2 breast tumours with less than three positive SLNs. Furthermore, 10-year of follow up has confirmed the absence of a difference in outcomes between the two groups [19]. Two other randomized trials have evaluated patients with micro metastasis (>0.2 mm but ≤ 2 mm), the IBCSG 23-01 trial (primary tumour <5 cm) and AATRM trial (primary tumour <3.5 cm) [20, 21]. Both showed no statistical significance in disease free survival [20, 21]. Thus, the place of ALND in those with locally advanced disease in <3 SNLs was disputed. Findings of these trials were incorporated into National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology [22] and American Society for Clinical Oncology (ASCO) guidelines.

With the establishment of SLNB as the standard of care, fewer nodes were available for pathological analysis and hence, immunohistochemistry gradually gained popularity. However, this resulted in identification of isolated tumour cells, which is defined as clusters of metastatic deposits of 0.2 mm or less in size, single tumour cells or clusters of <200 cells in a single cross-section [23]. Several prospective trials have shown no differences in overall survival rates between immunohistochemistry positive and negative patients [24]. Thus, most current guidelines do not recommend the routine use of immunohistochemistry of SLNs [22]. However isolated tumour cells may be clinically relevant in lobular tumours due to their non-cohesive growth patterns [25]. Therefore, nodal metastases may present as widely dispersed isolated tumour cells [25]. Thus some still perform immunohistochemistry of SNLs in patients with lobular cancers and consider ALND when isolated tumour cells are identified [23].

Axillary lymph node dissection vs. radiotherapy for positive lymph nodes

In the instances where the decision has been taken to proceed with treatment of axilla due to positive SNLs, ALND is considered as the standard. However, this is associated with substantial long-term morbidity. After Mapping of the Axilla, Radiotherapy or Surgery (AMAROS) trial evaluated the place of axillary radiotherapy instead of ALND [26]. This multicentre randomised, phase three non-inferiority clinical trial included patients with T1 and T2 breast cancers with absent clinical lymphadenopathy and were randomized into

ALND or axillary radiotherapy. After a median follow up of over 6 years, comparable axillary control with less morbidity was observed in axillary radiotherapy group.

Sentinel node biopsy in women older than 70 years

Elderly patients over 70 years of age with clinical stage I (T1N0M0) and oestrogen receptor positive breast carcinoma have less aggressive course of disease. Studies have shown these patients to have no difference in mortality with no surgery for the axilla compared with ALND [27, 28]. The impact of avoiding radiotherapy in elderly patients undergoing breast conserving surgery was analysed in Cancer and Leukemia Group B 9343 trial. This trial randomized elderly women into radiotherapy with tamoxifen versus tamoxifen only. This study showed that adjuvant radiotherapy did not alter the local recurrence rates or survival of these patients who had oestrogen receptor positive early breast cancers [27]. However, this trial was conducted prior to the era of standard SLNB, and as a result 60% of the patients did not undergo axillary surgery. Therefore, these results could be biased due to the inclusion of patients into node negative group based on clinical evaluation alone. Some current guidelines including the Society of Surgical Oncology recommend the omission of routine SLNB in females over 70 years of age with hormone receptor positive and clinically negative axilla [29]. Furthermore, the latest NCCN guidelines recommend SLNB as optional in women older than 70 years with tumours with favourable prognostic characteristics, in whom axillary staging has no effect on the decisions regarding systemic adjuvant treatment [22].

Place of sentinel node biopsy in patients undergoing neoadjuvant chemotherapy

Neoadjuvant chemotherapy may be used in patients with clinically negative axilla at presentation due to unfavourable tumour biology, large primary tumour and patients' wish for breast conservative treatment. Although there is consensus that these patients should undergo SLNB, the timing of SLNB is controversial. Data from M.D. Anderson Cancer Centre have shown that comparable false negative rates (5.9% vs. 4.1% in neoadjuvant and in surgery first group respectively, $p=0.39$) with no significant differences in overall or disease free survival rates [30]. Interestingly, patients undergoing SLNB post-neoadjuvant chemotherapy showed significantly lower rates of positive SLNs in T1 to T3 tumour categories (T1 tumours: 12.7% vs. 19%, $p=0.2$; T2 tumours: 20.5% vs. 36.5%, $p<0.0001$; and T3 tumours: 30.4% vs. 51.4%, $p=0.04$). Dual tracer method with removal of two or more sentinel nodes are recommended to reduce the false negative rates associated with SNB after neoadjuvant therapy [30].

Management of the clinically positive axilla

Avoiding axillary surgery is beneficial to the patient due to its associated side effects, some of which carry a substantial morbidity. However, ALND is still considered as the routine

standard for patients with clinical, radiologically or pathologically proven positive axillae. Furthermore, ALND is performed when SLNB fails or when it is contraindicated. Standard ALND which removes level I and II axillary lymph nodes preserving the axillary vein, thoracodorsal neurovascular pedicle, and the long thoracic nerve allows comprehensive staging of the axilla. Level III clearance is not performed routinely except in situations where level III nodes are clinically involved due to the excess risk of surgical morbidity.

Patients with axillary disease often receive neoadjuvant chemotherapy and with the advancement of efficacy of the agents, response to treatment has also improved with nodal eradication rates of approximately 40% [31]. ACOSOG-Z1071 (Alliance) prospective multicentre clinical trial revealed variable nodal conversion rates depending on the receptor status of the tumour [31]. Conversion rates were 21.1% for ER/PR positive, HER-2 negative tumours; 49.4% for triple negative tumours and 64.7% for HER-2 positive tumours. Usage of dual tracer technique and removal of three or more sentinel lymph nodes have shown to reduce FNR in this group of patients [32].

Routine use of ALND in patients with clinically node negative axillae after neoadjuvant therapy has been brought to question as there was an increasingly higher complete pathological response rates in the axilla. Three large prospective registry studies have evaluated the role of SLNB followed by ALND after completion of neoadjuvant chemotherapy in clinically T1-4, N1-2, M0 breast cancers who received neoadjuvant chemotherapy [32-34]. Of these the ACOSOG-Z0171 trial evaluated the FNR of SLNB and reported a FNR of 12.6% (90% CI=9.85%–16.05%). The use of dual tracers, harvesting three or more SLN and use of immunohistochemistry were shown to reduce the FNR substantially [32]. Furthermore, ultrasonography was shown to be highly unreliable in assessing the nodal response of neoadjuvant therapy. Of the 430 patients with negative nodes on ultrasonography after neoadjuvant chemotherapy, 243 (56.5%) had residual positive nodes. Furthermore, 28.2% (51/181) of patients with suspicious nodes on ultrasonography after neoadjuvant chemotherapy were found to be negative pathologically [35]. The SENTinel NeoAdjuvant (SENTINA) study which was a multicentre European trial showed similar findings in terms of FNR with an overall FNR of 14.2% [34]. However, in that trial only 25% underwent pathological confirmation of nodal disease before neoadjuvant chemotherapy.

The ACOSOG Z1071 studied the usefulness of placing a nodal clip in 170 patients with biopsy-proven nodal disease. In 75.9% patients with more than two SLNs retrieved, the clip was found to be inside the retrieved SLN with a FNR of 6.8% (95% CI=1.9%–16.5%) [36]. Much higher FNRs were

reported when a clip was not used or when the clip could not be retrieved during surgery (13.4% and 14.3%, respectively) [36]. Hence, retrieving the clipped node with previously confirmed disease, which may or may not be the SLN, is recommended to be added to surgical staging of axilla after neoadjuvant chemotherapy. Targeted axillary dissection is a newer technique which removes both the sentinel nodes and the clipped node, which would help minimize morbidity of ALND while maintaining an acceptability low FNR. Several current studies are evaluating the usefulness of targeted axillary dissection in comparison to the existing techniques[23].

There is still a controversy surrounding the management of pre-neoadjuvant node-positive patients who become node negative after neoadjuvant chemotherapy. At present, there is insufficient good quality data evaluating the oncological outcomes of excluding ALND in this group of patients. However, some are already practising SLNB instead of primary ALND for these patients [23].

Minimizing morbidity of SNB/ALND – Axillary reverse mapping (ARM)

ARM is the mapping of the arm and the breast lymphatic drainage systems simultaneously so that nodes draining the upper limb can be identified separately from the nodes that drain the breast [37]. This is performed with two different types of mapping agents injected simultaneously to the arm and the breast i.e. radioisotope to the breast and blue dye to the arm. With this technique, it is feasible to identify the lymphatics and nodes draining the upper limb and preserve them. However, the preservation of crossover nodes draining both the arm and the breast may result in suboptimal oncological lymph node clearances. A recently published meta-analysis has confirmed the feasibility of ARM and the significantly low rates of lymphedema associated with ARM compared with standard ALND [38]. However, further studies are needed to confirm the oncological safety of this technique before it could be incorporated in to standard practice.

Future perspectives in the management of axilla in breast cancer

Several prospective, multicentre, randomized controlled trials are in progress to address the above concerns in clinically node positive patients who receive neoadjuvant chemotherapy. NSABP B-51/Radiation Therapy Oncology Group 1304 Trial is an ongoing randomized phase three clinical trial including patients with T1 to T3, FNAC proven positive axillary nodes undergoing neoadjuvant chemotherapy [23]. Patients with clinically node negative axillae post neoadjuvant therapy are randomized to receive no nodal irradiation versus nodal irradiation. Outcomes of interest in this study include overall and disease-free survival and quality of life in irradiated versus non-irradiated patients [23].

Another ongoing randomized trial, the Alliance A11202 trial is studying the impact of avoiding routine regional nodal irradiation after ALND in patients with residual positive nodal disease after neoadjuvant chemotherapy [23]. The outcomes of interest of this study include overall and disease free survival and incidence of lymphedema in the two groups [23].

Future research will focus to identify patients who have low risk axillary nodal disease where surgery of the axilla can be avoided altogether. To this end, some preliminary studies have shown potential of gene expression profiling in predicting nodal involvement which may potentially help avoid axillary surgery.

Conclusion

The principles of surgical management of ALNs in breast cancer has undergone a major change from the initial radical surgery to minimally invasive and then to no surgery at all at least in some selected groups of patients. SLNB as the standard of care in patients with early breast cancer is well established, and the indications for ALND is becoming less and less due to associated surgical morbidity. Accurate evaluation of ALNs is important in decision making and clinicians should be aware of the pros and cons of various techniques of axillary staging. The role of SLNB after neoadjuvant therapy in clinically negative axilla is gradually being incorporated in practice. However, SLNB after neoadjuvant treatment in clinically positive axilla is still not well established as a routine due to the high FNR. Further studies will be useful to assess the role of SLNB after neoadjuvant chemotherapy in patients with clinically positive axillae. Current and future research focus on identifying patients with an acceptably low risk ALN metastasis where axillary surgery could be omitted.

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References

1. Fernando A, Jayarajah U, Prabashani S, Fernando EA, Seneviratne S A. Incidence trends and patterns of breast cancer in Sri Lanka: an analysis of the national cancer database. *BMC Cancer*. 2018;18(1):482. <https://doi.org/10.1186/s12885-018-4408-4>
2. Kesson EM, Allardice GM, George WD, Burns HJ, Morrison DS. Effects of multidisciplinary team working on breast cancer survival: retrospective, comparative, interventional cohort study of 13 722 women. *BMJ*. 2012;344:e2718. <https://doi.org/10.1136/bmj.e2718>
3. Virchow R, Chance F. Cellular Pathology as based upon physiological and pathological histology. Twenty lectures delivered in... 1858. Translated from the second edition of the original by F. Chance. With notes and numerous emendations principally from MS. notes of the author, and illustrated by... engravings on wood 1860.

4. Halsted WS. I. The results of operations for the cure of cancer of the breast performed at the Johns Hopkins Hospital from June, 1889, to January, 1894. *Ann Surg*. 1894;20(5):497. <https://doi.org/10.1097/0000658-189407000-00075>
5. Patey D, Dyson W. The prognosis of carcinoma of the breast in relation to the type of operation performed. *Br J Cancer*. 1948;2(1):7. <https://doi.org/10.1038/bjc.1948.2>
6. Auchincloss H. Modified radical mastectomy: why not? *The American Journal of Surgery*. 1970;119(5):506-9. [https://doi.org/10.1016/0002-9610\(70\)90163-7](https://doi.org/10.1016/0002-9610(70)90163-7)
7. Kennedy CS, Miller E. Simple mastectomy for mammary carcinoma. *Ann Surg*. 1963;157:161.
8. Toth BA, Lappert P. Modified skin incisions for mastectomy: the need for plastic surgical input in preoperative planning. *Plast Reconstr Surg*. 1991;87(6):1048-53. <https://doi.org/10.1097/00006534-199106000-00006>
9. Rastogi P, Wickerham DL, Geyer Jr CE, Mamounas EP, Julian TB, Wolmark N. Milestone clinical trials of the National Surgical Adjuvant Breast and Bowel Project (NSABP). *Chinese clinical oncology*. 2017;6(1):7. <https://doi.org/10.21037/cco.2017.02.02>
10. Sacre R. Clinical evaluation of axillar lymph nodes compared to surgical and pathological findings. *European journal of surgical oncology: the journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology*. 1986;12(2):169-73.
11. Tanis PJ, Nieweg OE, Olmos RAV, Kroon BB. Anatomy and physiology of lymphatic drainage of the breast from the perspective of sentinel node biopsy. *J Am Coll Surg*. 2001;192(3):399-409. [https://doi.org/10.1016/S1072-7515\(00\)00776-6](https://doi.org/10.1016/S1072-7515(00)00776-6)
12. Povoski SP, Olsen JO, Young DC, Clarke J, Burak WE, Walker MJ, Carson WE, Yee LD, Agnese DM, Pozderac RV. Prospective randomized clinical trial comparing intradermal, intraparenchymal, and subareolar injection routes for sentinel lymph node mapping and biopsy in breast cancer. *Ann Surg Oncol*. 2006;13(11):1412-21. <https://doi.org/10.1245/s10434-006-9022-z>
13. Tanis P, Nieweg O, Olmos RV, Peterse J, Rutgers ET, Hoefnagel C, Kroon B. Impact of non-axillary sentinel node biopsy on staging and treatment of breast cancer patients. *Br J Cancer*. 2002;87(7):705. <https://doi.org/10.1038/sj.bjc.6600359>
14. Ahmed M, Purushotham AD, Douek M. Novel techniques for sentinel lymph node biopsy in breast cancer: a systematic review. *The Lancet Oncology*. 2014;15(8):e351-e62. [https://doi.org/10.1016/S1470-2045\(13\)70590-4](https://doi.org/10.1016/S1470-2045(13)70590-4)
15. Krag DN, Anderson SJ, Julian TB, Brown AM, Harlow SP, Ashikaga T, Weaver DL, Miller BJ, Jalovec LM, Frazier TG. Technical outcomes of sentinel-lymph-node resection and conventional axillary-lymph-node dissection in patients with clinically node-negative breast cancer: results from the NSABP B-32 randomised phase III trial. *The lancet oncology*. 2007;8(10):881-8. [https://doi.org/10.1016/S1470-2045\(07\)70278-4](https://doi.org/10.1016/S1470-2045(07)70278-4)
16. Mansel RE, Fallowfield L, Kissin M, Goyal A, Newcombe RG, Dixon JM, Yiangou C, Horgan K, Bundred N, Monypenny I. Randomized multicenter trial of sentinel node biopsy versus standard axillary treatment in operable breast cancer: the ALMANAC Trial. *J Natl Cancer Inst*. 2006;98(9):599-609. <https://doi.org/10.1093/jnci/djj158>
17. Veronesi U, Viale G, Paganelli G, Zurrada S, Luini A, Galimberti V, Veronesi P, Intra M, Maisonneuve P, Zucca F. Sentinel lymph node biopsy in breast cancer: ten-year results of a randomized controlled study. *Ann Surg*. 2010;251(4):595-600. <https://doi.org/10.1097/SLA.0b013e3181c0e92a>

18. Caudle AS, Hunt KK, Tucker SL, Hoffman K, Gainer SM, Lucci A, Kuerer HM, Meric-Bernstam F, Shah R, Babiera GV. American College of Surgeons Oncology Group (ACOSOG) Z0011: impact on surgeon practice patterns. *Ann Surg Oncol*. 2012;19(10):3144-51.
<https://doi.org/10.1245/s10434-012-2531-z>
19. Giuliano AE, Ballman KV, McCall L, Beitsch PD, Brennan MB, Kelemen PR, Ollila DW, Hansen NM, Whitworth PW, Blumencranz PW. Effect of axillary dissection vs no axillary dissection on 10-year overall survival among women with invasive breast cancer and sentinel node metastasis: the ACOSOG Z0011 (Alliance) randomized clinical trial. *JAMA*. 2017;318(10):918-26.
<https://doi.org/10.1001/jama.2017.11470>
20. Galimberti V, Cole BF, Zurrada S, Viale G, Luini A, Veronesi P, Baratella P, Chifu C, Sargenti M, Intra M. Axillary dissection versus no axillary dissection in patients with sentinel-node micrometastases (IBCSG 23-01): a phase 3 randomised controlled trial. *The lancet oncology*. 2013;14(4):297-305.
[https://doi.org/10.1016/S1470-2045\(13\)70035-4](https://doi.org/10.1016/S1470-2045(13)70035-4)
21. Solá M, Alberro JA, Fraile M, Santesteban P, Ramos M, Fabregas R, Moral A, Ballester B, Vidal S. Complete axillary lymph node dissection versus clinical follow-up in breast cancer patients with sentinel node micrometastasis: final results from the multicenter clinical trial AATRM 048/13/2000. *Ann Surg Oncol*. 2013;20(1):120-7.
<https://doi.org/10.1245/s10434-012-2569-y>
22. National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology: Breast, Version 2017. Available at: <http://www.nccn.org/>. Accessed August 22, 2018.
23. Park KU, Caudle A. Management of the Axilla in the Patient with Breast Cancer. *Surg Clin North Am*. 2018.
<https://doi.org/10.1016/j.suc.2018.04.001>
24. Giuliano AE, Hawes D, Ballman KV, Whitworth PW, Blumencranz PW, Reintgen DS, Morrow M, Leitch AM, Hunt KK, McCall LM, Abati A, Cote R. Association of occult metastases in sentinel lymph nodes and bone marrow with survival among women with early-stage invasive breast cancer. *JAMA*. 2011;306(4):385-93.
<https://doi.org/10.1001/jama.2011.1034>
25. Mittendorf EA, Sahin AA, Tucker SL, Meric-Bernstam F, Yi M, Nayeemuddin KM, Babiera GV, Ross MI, Feig BW, Kuerer HM, Hunt KK. Lymphovascular Invasion and Lobular Histology are Associated with Increased Incidence of Isolated Tumor Cells in Sentinel Lymph Nodes from Early-Stage Breast Cancer Patients. *Ann Surg Oncol*. 2008;15(12):3369-77.
<https://doi.org/10.1245/s10434-008-0153-2>
26. Donker M, van Tienhoven G, Straver ME, Meijnen P, van de Velde CJ, Mansel RE, Cataliotti L, Westenberg AH, Klinkenbijn JH, Orzalesi L. Radiotherapy or surgery of the axilla after a positive sentinel node in breast cancer (EORTC 10981-22023 AMAROS): a randomised, multicentre, open-label, phase 3 non-inferiority trial. *The lancet oncology*. 2014;15(12):1303-10.
[https://doi.org/10.1016/S1470-2045\(14\)70460-7](https://doi.org/10.1016/S1470-2045(14)70460-7)
27. Hughes KS, Schnaper LA, Bellon JR, Cirrincione CT, Berry DA, McCormick B, Muss HB, Smith BL, Hudis CA, Winer EP. Lumpectomy plus tamoxifen with or without irradiation in women age 70 years or older with early breast cancer: long-term follow-up of CALGB 9343. *J Clin Oncol*. 2013;31(19):2382.
<https://doi.org/10.1200/JCO.2012.45.2615>
28. Martelli G, Boracchi P, Ardoino I, Lozza L, Bohm S, Vetrilla G, Agresti R. Axillary dissection versus no axillary dissection in older patients with T1N0 breast cancer: 15-year results of a randomized controlled trial. *Ann Surg*. 2012;256(6):920-4.
<https://doi.org/10.1097/SLA.0b013e31827660a8>
29. Landerasper J, Bailey L, Berry TS, Buras RR, Degnim AC, Fayanju OM, Froman J, Gass J, Greenberg C, Mautner SK. Measures of Appropriateness and Value for Breast Surgeons and Their Patients: The American Society of Breast Surgeons Choosing Wisely® Initiative. *Ann Surg Oncol*. 2016;23(10):3112-8.
<https://doi.org/10.1245/s10434-016-5327-8>
30. Hunt KK, Yi M, Mittendorf EA, Guerrero C, Babiera GV, Bedrosian I, Hwang RF, Kuerer HM, Ross MI, Meric-Bernstam F. Sentinel lymph node surgery after neoadjuvant chemotherapy is accurate and reduces the need for axillary dissection in breast cancer patients. *Ann Surg*. 2009;250(4):558-66.
<https://doi.org/10.1097/SLA.0b013e3181b8fd5e>
31. Boughey JC, McCall LM, Ballman KV, Mittendorf EA, Ahrendt GM, Wilke LG, Taback B, Leitch AM, Flippo-Morton T, Hunt KK. Tumor biology correlates with rates of breast-conserving surgery and pathologic complete response after neoadjuvant chemotherapy for breast cancer: findings from the ACOSOG Z1071 (Alliance) Prospective Multicenter Clinical Trial. *Ann Surg*. 2014;260(4):608.
<https://doi.org/10.1097/SLA.0000000000000924>
32. Boughey JC, Suman VJ, Mittendorf EA, Ahrendt GM, Wilke LG, Taback B, Leitch AM, Kuerer HM, Bowling M, Flippo-Morton TS. Sentinel lymph node surgery after neoadjuvant chemotherapy in patients with node-positive breast cancer: the ACOSOG Z1071 (Alliance) clinical trial. *JAMA*. 2013;310(14):1455-61.
<https://doi.org/10.1001/jama.2013.278932>
33. Boileau J-F, Poirier B, Basik M, Holloway CMB, Gaboury L, Sideris L, Meterissian S, Arnaout A, Brackstone M, McCready DR, Karp SE, Trop I, Lisbona A, Wright FC, Younan RJ, Provencher L, Patocskaï E, Omeroglu A, Robidoux A. Sentinel Node Biopsy After Neoadjuvant Chemotherapy in Biopsy-Proven Node-Positive Breast Cancer: The SN FNAC Study. *J Clin Oncol*. 2015;33(3):258-64.
<https://doi.org/10.1200/JCO.2014.55.7827>
34. Kuehn T, Bauerfeind I, Fehm T, Fleige B, Hausschild M, Helms G, Lebeau A, Liedtke G, Minckwitz Gv, Nekljudova V, Schmatloch S, Schrenk P, Staebler A, Untch M. Sentinel-lymph-node biopsy in patients with breast cancer before and after neoadjuvant chemotherapy (SENTINA): a prospective, multicentre cohort study. *The Lancet Oncology*. 2013;14(7):609-18. [https://doi.org/10.1016/S1470-2045\(13\)70166-9](https://doi.org/10.1016/S1470-2045(13)70166-9)
35. Boughey JC, Ballman KV, Hunt KK, McCall LM, Mittendorf EA, Ahrendt GM, Wilke LG, Le-Petross HT. Axillary ultrasound after neoadjuvant chemotherapy and its impact on sentinel lymph node surgery: results from the American College of Surgeons Oncology Group Z1071 Trial (Alliance). *J Clin Oncol*. 2015;33(30):3386. <https://doi.org/10.1200/JCO.2014.57.8401>
36. Boughey JC, Ballman KV, Le-Petross HT, McCall LM, Mittendorf EA, Ahrendt GM, Wilke LG, Taback B, Feliberti EC, Hunt KK. Identification and Resection of Clipped Node Decreases the False-negative Rate of Sentinel Lymph Node Surgery in Patients Presenting With Node-positive Breast Cancer (T0-T4, N1-N2) Who Receive Neoadjuvant Chemotherapy: Results From ACOSOG Z1071 (Alliance). *Ann Surg*. 2016;263(4):802-7.
<https://doi.org/10.1097/SLA.0000000000001375>
37. Thompson M, Korourian S, Henry-Tillman R, Adkins L, Mumford S, Westbrook KC, Klimberg VS. Axillary reverse mapping (ARM): a new concept to identify and enhance lymphatic preservation. *Annals of surgical oncology*. 2007;14(6):1890. <https://doi.org/10.1245/s10434-007-9412-x>
38. Ahmed M, Rubio I, Kovacs T, Klimberg V, Douek M. Systematic review of axillary reverse mapping in breast cancer. *British Journal of Surgery*. 2016;103(3):170-8.
<https://doi.org/10.1002/bjs.10041>

Submucosal tunnelling endoscopic resection: first successful experience from Sri Lanka and a review of the literature

B. P. N Wijerathne, C. N Wijesurendere, T. Wijerathne

University Surgical Unit, Colombo South Teaching Hospital, Kalubowila, Sri Lanka

Key words: Submucosal tunneling endoscopic resection; lipoma of oesophagus

Introduction

Submucosal Tunnelling Endoscopic procedures are novel popular techniques for successful treatment of upper gastrointestinal conditions such as Achalasia of cardia and mural lesions of the oesophagus.

Presentation

A sixty four year old farmer presented with a history of dysphagia and regurgitation for eight months. He had a poor response to medical management of reflux and had grade-2 dysphagia at presentation. During upper gastrointestinal endoscopy, we found two submucosal lesions protruding to the lumen at 27 cm and 38 cm and a type-1 hiatus hernia.

Contrast enhanced computerized tomography (CECT) showed two adjacent well circumscribed submucosal masses measuring 2.2cm and 2.5cm with calcifications within. There were no features to suggest infiltration. It was compatible with two submucosal lipomas of the oesophagus. A decision was made to perform STERT procedure.

Under general anaesthesia, the patient was positioned supine. The procedure was performed by a surgeon experienced in therapeutic upper gastrointestinal endoscopy. Initially, gastroscopy was performed to assess the position of the lesion for accurate planning. Methylene blue was used to inject into the submucosa to facilitate submucosal dissection. A vertical incision with diathermy was made approximately 5cm above the proximal lesion. The tip of the endoscope was negotiated into the submucosal space and carbon dioxide was inflated.

Dissection of the submucosal space was carried out with a hybrid knife which combines a water jet and monopolar diathermy. Both lesions were carefully dissected out, grasped with a snare and removed separately. Haemostasis was confirmed and the mucosal entry site was closed with

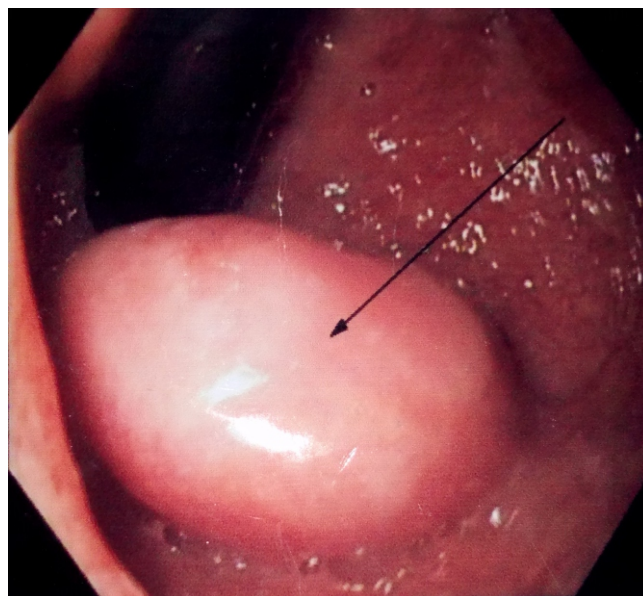


Figure 1. Endoscopic view of the submucosal mass (arrow) in the lower oesophagus

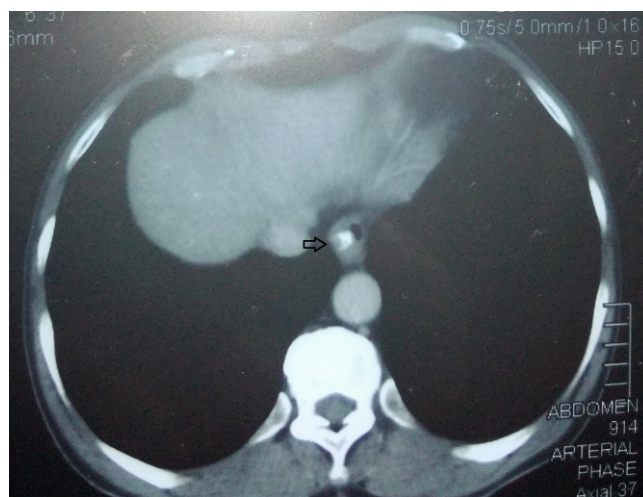



Figure 2. The CECT showing the calcified mass (arrow) at lower oesophagus

endoscopic clips. The operative time was ninety minutes. The patient was kept nil by mouth for 24 hours and oral intake was established gradually. He was discharged on the third day. The histology of both lesions confirmed that they were lipomas. The patient made a good recovery and dysphagia was completely improved after the procedure.

Correspondence: Chinthaka Wijesurendere

E-mail: cnwijesurendere@gmail.com

Received: 10-08-2018 Accepted: 03-11-2018

 <http://orcid.org/0000-0002-0631-2449>

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Discussion

Endoscopic submucosal dissection (ESD) is now becoming widely used for removal of benign and early malignant tumours of the gastrointestinal tract namely the oesophagus, stomach, colon and rectum. This method was first conceptually introduced to the world by Japanese gastroenterologists approximately 30 years ago and it is practised widely in East Asia [1, 2]. Its main advantage over other endoscopic resection techniques such as endoscopic mucosal resection (EMR) is the ability to obtain en-bloc removal of lesions. This has enabled a superior histological assessment and a better treatment outcome [3]. To date, there are no reports on STERT/EMR procedures from Sri Lanka.

While there are numerous (Japanese, European and American etc.) guidelines available on lesion selection in cancer, there is no published guide on a selection of benign lesions of the oesophagus for ESD. While 2cm is the cut-off diameter for malignant lesions considered for ESD, there is no cut-off size for benign lesions for STERT procedure of oesophagus [4].

When it comes to patient selection, endosonography is an adjunct other than endoscopic assessment and CECT which was not used in our case.

Technology is constantly being evolved. High definition therapeutic endoscopy with a single instrument channel being the basic prerequisite, scopes with higher magnification with optical zoom, dual instrument channels and enhanced flexibility are some of the new developments that are currently available [5]. Gas insufflations with carbon dioxide has been proven to be superior to standard air in producing lower rates of mediastinal emphysema and post procedure discomfort in a randomized study [6].

STERT is essentially natural orifice transluminal endoscopic surgery. Hence, its key advantage to the patient is a scar-less operation. It also eliminates most complications related to conventional surgery for such conditions (laparoscopic or open) such as post-op pain, wound complications, hernia, thromboembolism etc.

STERT/ESD is technically demanding when compared to endoscopic mucosal resection (EMR) with a higher rate of complications such as bleeding, perforation and stricture formation. In a review by Isomoto et al, a pooled perforation rate in a large series of oesophageal ESD was 2.3 % [7].

In Sri Lanka, we're still at a preliminary stage with ESD/STERT and the avenues of ESD are yet to be explored. Strategies could be developed for identification of cancers at an earlier stage for use of this method and establishment of a few high-volume centres for advanced therapeutic endoscopy such as ESD/STERT is a necessity in Sri Lanka.

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.

References

1. Hirao M, Masuda K, Asanuma T, Naka H, Noda K, Matsuura K, et al. Endoscopic resection of early gastric cancer and other tumors with local injection of hypertonic saline-epinephrine. *Gastrointest Endosc* [Internet];34(3):264–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/3391382>
2. Ma MX, Bourke MJ. Endoscopic submucosal dissection in the West: current status and future directions. *Dig Endosc* [Internet]. 2017 Sep 7; Available from: <http://www.ncbi.nlm.nih.gov/pubmed/28884493> <https://doi.org/10.1111/den.12960>
3. Xu M-D, Cai M-Y, Zhou P-H, Qin X-Y, Zhong Y-S, Chen W-F, et al. Submucosal tunneling endoscopic resection: a new technique for treating upper GI submucosal tumors originating from the muscularis propria layer (with videos). *Gastrointest Endosc* [Internet]. 2012 Jan;75(1):195–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22056087> <https://doi.org/10.1016/j.gie.2011.08.018>
4. Ono H, Yao K, Fujishiro M, Oda I, Nimura S, Yahagi N, et al. Guidelines for endoscopic submucosal dissection and endoscopic mucosal resection for early gastric cancer. *Dig Endosc* [Internet]. 2016 Jan;28(1):3–15. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/26234303> <https://doi.org/10.1111/den.12518>
5. Maple DO, FASGE JT, Abu Dayyeh MPH, BK, Chauhan FASGE SS, Ha Hwang FASGE J, Komanduri S, Manfredi M, et al. Endoscopic submucosal dissection. 2015 Available <https://doi.org/10.1016/j.gie.2014.12.010>
6. Maeda Y, Hirasawa D, Fujita N, Ohira T, Harada Y, Yamagata T, et al. Carbon dioxide insufflation in esophageal endoscopic submucosal dissection reduces mediastinal emphysema: A randomized, double-blind, controlled trial. *World J Gastroenterol* [Internet]. 2016 Aug 28;22(32):7373–82. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/27621583> <https://doi.org/10.3748/wjg.v22.i32.7373>
7. Isomoto H, Yamaguchi N, Minami H, Nakao K. Management of complications associated with endoscopic submucosal dissection/ endoscopic mucosal resection for esophageal cancer. *Dig Endosc* [Internet]. 2013 Mar;25:29–38. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23368404> <https://doi.org/10.1111/j.1443-1661.2012.01388.x>

The vital step in successful laparoscopic adrenalectomy: Identifying the adrenal vein

Bawantha Gmamage¹, S. H. R Sanjeeva², H. K. K. T Duminda³

¹University of Sri Jayewardenapura, Sri Lanka

²Teaching Hospital Kandy, Sri Lanka

³Kaththankudi Base Hospital, Sri Lanka

Key words: Laparoscopic adrenalectomy; adrenal vein; schwannoma

Introduction

Laparoscopic adrenalectomy (LA) is the procedure of choice for most of the small and medium-sized adrenal tumours [1]. During this procedure paying attention to the haemostasis is of paramount importance for technical success, as the adrenal gland is a highly vascular endocrine organ. To achieve this, the most important initial step is to have a good understanding of the anatomy especially the blood supply of the gland. Usually, each adrenal gland is drained via a single central vein and, the right vein drains into the inferior vena cava (IVC) and the left vein, after joining the inferior phrenic vein drains into the left renal vein. But there are anatomical variants which are very significant in technical point of view for the surgeon.

Case presentation

A 37-year-old male who presented with left loin discomfort found to have left-sided non-secreting 73mm x 63mm adrenal mass with atypical phenotype in the contrast-enhanced CT scan. It showed a density of 24H. During LA, we encountered a renal vein abutting the adrenal mass and with lateral displacement of the adrenal vein. The patient underwent the procedure with less than 100 ml of blood loss. He was discharged on the 2nd postoperative day without any complications. The histology revealed a Schwannoma which is confirmed by immunohistochemistry.

Surgical Technique

The surgery was performed under general anaesthesia with the right semi-decubitus position with 4 port entry (Figure 1). The proximal left colon and the splenic flexure were mobilized downwards and medially. Then, the splenorenal ligament was divided and the spleen and the pancreas were mobilized medially to expose the left adrenal area. Identification of the pancreas and the splenic vein lying on the posterior wall of the pancreas is the first step in a medial mobilization of the spleen and the pancreas. During inferior

mobilization of the mass, it was noted that the left renal vein abutted the mass and the left adrenal vein was joining the left renal vein laterally, more towards the renal hilum (Figure 2). The main clue to suspect the renal vein at the lower border of the mass was the slight oscillations of the renal vein. The left adrenal vein was clipped with Haemolock clip and the renal vein was carefully separated from the mass with mono-polar diathermy hook.



Figure 1. Right semi-decubitus position with 4 port entry

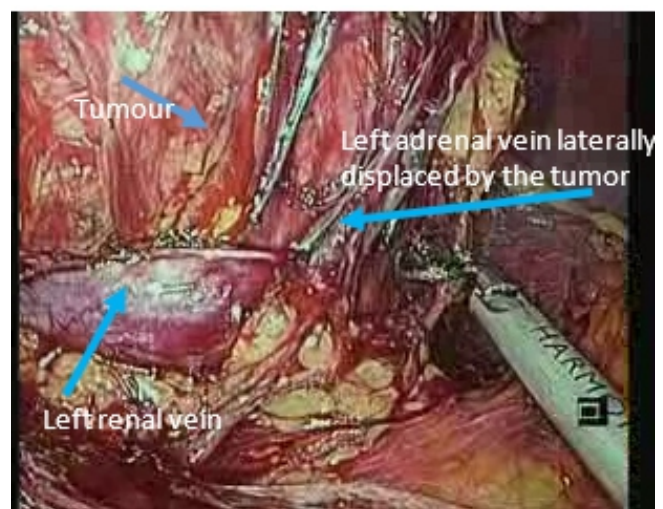



Figure 2. Identification of adrenal vein

Correspondence: Bawantha Gmamage

E-mail: bawantha@sjp.ac.lk

Received: 27-11-2018 Accepted: 25-12-2018

 <https://orcid.org/0000-0003-4381-228X>

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Discussion

Maintenance of haemostasis during laparoscopic adrenalectomy is important. To achieve this the bottom-line is the identification of adrenal veins which may show various anatomical variations. Failing to identify the vein increases the risk of bleeding leading to conversion to open surgery.

During embryogenesis, adrenal veins form during the development of the prerenal inferior vena cava (IVC). They are the remnants of the lower portion of the subcardinal veins, superior to the subcardinal sinus. There are many communications between the posterior cardinal, supra-cardinal, and subcardinal veins of the primitive venous system. Understanding these multiple communications helps to explain the most likely cause for the anatomical variants identified during later in the life.

Variability of adrenal vein anatomy has been described as 13% during laparoscopic adrenalectomies [4]. Anomalies of left adrenal vein comprises of draining directly to the renal vein without receiving the inferior phrenic vein; bifid adrenal vein; formation of two left adrenal veins; connecting to one of the duplicated gonadal veins; and direct drainage to the IVC [2]. Drainage of the left adrenal vein in to the left renal vein lateral to the adrenal gland has not been described. Knowledge regards to these variants are vital for surgeons who perform adrenalectomies as well as interventional radiologists doing adrenal vein sampling for diagnosis of primary hyperaldosteronism.

Firstly, if we had not identified the left renal vein it would have caused a torrential bleed resulting in conversion to open procedure, which is not the gold standard for tumors less than 12 cm in size [5]. Inferior mobilization of the left adrenal gland is advised in operative anatomy literature for early clipping of the left adrenal vein [5]. On the other hand, it would be a catastrophe to have a hole in the left renal vein because it warrants the control from either side of the bleed as there are no valves in renal veins. In our patient, the adrenal vein was medial and inferior to the left adrenal gland. Therefore, this might not be a true anomaly but rather displacement of the vein by the large tumor.

Various drainage patterns of adrenal–renal vein complex has been described in cadaveric studies and during adrenalectomies [2]. The commonest anatomical variant detected has been two adrenal veins draining from each gland when compared to a one central vein [4]. Other variants described were right adrenal vein draining into the hepatic vein or to the right inferior phrenic vein and the variants of the left adrenal vein were it drains in to the left renal vein without connecting to the left inferior phrenic vein, bifid adrenal vein and adrenal vein directly draining to the IVC [2,4]. It was noted that these anatomical variants were more commonly detected on the right side (4). Surgeons must be aware of the anomalies and displacements to achieve an optimal surgical outcome with minimal 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.

References

1. Gagner M, Lacroix A, Bolte E. Laparoscopic adrenalectomy in cushing's syndrome and pheochromocytoma. *N Engl J Med.*1992;327 (14):1033. [pubmed:1387700]
2. Kaitlin M. F, Sara S. Juan CPL. Anomalous adrenal vein anatomy complicating the evaluation of primary hyperaldosteronism. *Radiol Case Rep.*2018 Feb;13(1):139-141. doi.org/10.1016/j.radcr.2017.09.010
3. Cesmebasi A, Du Plessis M, Lannatuono M, Shah S, Tubbs RS, Loukas M.A review of the anatomy and clinical significance of adrenal veins. *Clin Anat.*2014 Nov;27 (8):1253- 63. doi.org/10.1002/ca.22374.Epub 2014 Apr 15.
4. Scholten A, Cisco RM, Vriens MR, Shen WT, Duh QY. Variant adrenal venous anatomy in 546 laparoscopic adrenalectomies. *JAMA Surg.* 2013 Apr;148 (4):378-83. doi.org/10.1001/jamasurg.2013.610.
5. Matthew J Mellon, Amanjot Sethi, Chandru P Sundaram. Laparoscopic adrenalectomy: Surgical techniques. *Indian J Urol.* 2008 Oct-Dec;24(4):583-589. doi.org/10.4103/0970-1591.44277.

Learning Points:

- Meticulous attention to positioning the patient and placement of the ports will assist in better delineation of the surgical anatomy during adrenalectomy.
- Initial identification of the adrenal vein with its anatomical variations is crucial for performing a safe laparoscopic adrenalectomy.

Penetrating injury to Zone II of the neck causing laryngotracheal injury following a firecracker blast: first reported case

Mohamed Rifzan Jameel, Kuda Banda Galketiya, Thilina M Samarasinghe
Teaching Hospital, Peradeniya, Sri Lanka

Key words: Transthoracic oesophagotomy; oesophageal foreign body

Introduction

Penetrating injuries to the neck, are wounds extending deep to the platysma. They comprise 5–10% of all cases presenting as trauma to the emergency department and is a significant cause of mortality [1]. The incidence of laryngotracheal trauma is 1 in 30,000 admissions to emergency departments [2]. The management of neck injuries needs a quick assessment of the adequacy of airway, breathing and circulation and further management once the patient is stabilized [1].

We discuss a case of an unusual injury to the airway following a firecracker blast.

Case presentation

A 58-year-old male presented to the Emergency treatment Unit following a penetrating injury to the neck due to the repulsion of a domestic firecracker made using wood and gunpowder. On admission (40 minutes after the accident) he had a wound on the anterior aspect of the neck. He had stridor and laboured breathing. He had a respiratory rate of 20 breaths/minute. His pulse rate was 80/minute and blood pressure 125/83 mm Hg. The patient did not have subcutaneous emphysema or an expanding haematoma in the neck. On examination of the wound, the trachea was severed and the patient was breathing through the defect. Due to the risk of aspiration, urgent endotracheal intubation was done under laryngoscopic guidance by bridging the two ends the trachea and his airway was secured. Emergency exploration was done under general anaesthesia. During exploration, the haematoma was evacuated. There were no major bleeders apart from oozing from the traumatized soft tissue and they were controlled with electrocautery. The thyroid cartilage was shattered into many pieces. The upper part of the trachea was also damaged. Pieces of wood (parts of the domestic firecracker) were found within the wound. There was no major vascular injury. A tracheostomy was made below the original wound and a nasogastric tube was also placed. The

wound was closed with a corrugated rubber tube in situ. The patient was managed in the ICU for three days and was transferred back to the ward. A CT scan done postoperatively showed hyoid bone and thyroid cartilage fractures.



Figure 1. Wooden foreign body within the wound

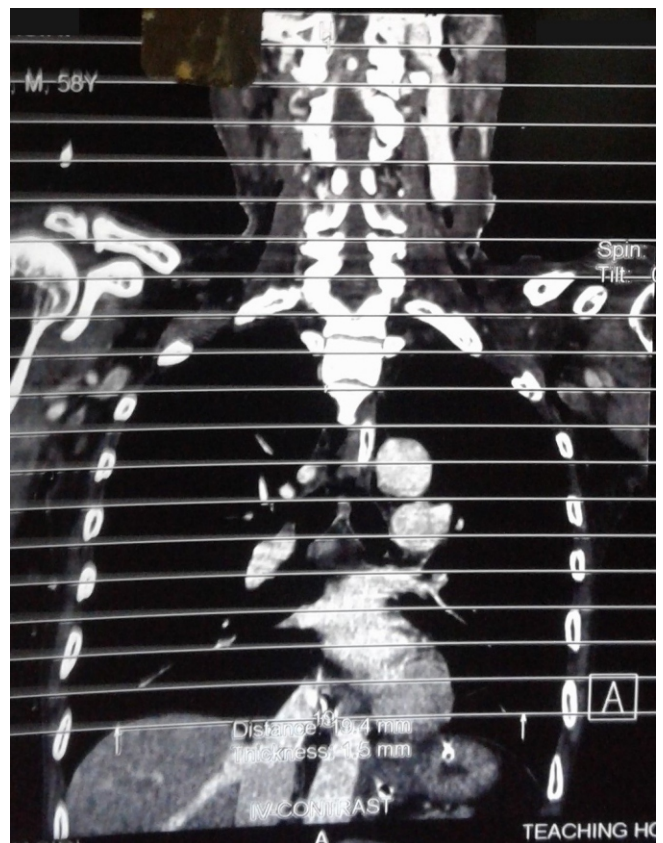



Figure 2. CT chest image showing shattered laryngeal

Correspondence: Mohamed Rifzan Jameel

E-mail: rifzan@yahoo.com

Received: 14-11-2018 Accepted: 25-12-2018

 <http://orcid.org/0000-0002-6855-7054>

DOI: <http://doi.org/10.4038/sljs.v36i4.8558>



The cervical vertebrae were normal. He was then transferred to an ENT unit for further management. The patient has been subsequently discharged with the tracheostomy with a plan for the delayed reconstruction of the laryngeal and tracheal cartilages. Reconstruction of the larynx and trachea was done at the ENT unit, 3 months after the initial injury and followed up monthly.

Discussion

Firecrackers have been part of civilization for a long time and mainly used in celebration of festivals. Due to its loud noise, it is also used by farmers to scare off animals which are a potential threat to the crops. The explosion has several detrimental effects such as burns, trauma to the eyes, and can cause deafness. The patient discussed had a penetrating injury to the Zone II of the neck causing laryngotracheal damage, with a threat to airway and breathing.

Penetrating neck injuries can present a difficult diagnostic and therapeutic dilemma. Their evaluation and management remain controversial [6]. Broadly the management can be classified into non-operative and operative. Advantages of non-operative management are avoidance of major surgery, but the patient needs to be under constant close monitoring. Whereas operative management deals with life-threatening complications.

Injury to the neck can be defined in three anatomical zones. Zone I is the area between the clavicle and the cricoid cartilage, Zone II is between the inferior margin of the cricoid cartilage and the angle of the mandible and Zone III is the area between the angles of the mandible to the base of the skull. The commonest are the Zone II injuries (50–80%) [3].

Prompt examination of patients with suspected laryngeal trauma is essential to identify those who require urgent airway intervention [1]. The goal is always to obtain and maintain a secure airway. Immediate intubation is necessary for patients with respiratory distress or increasing stridor. These patients should have a low threshold to be intubated and the fibre optic bronchoscope can be used in difficult cases. Signs of airway compromise such as minor endolaryngeal lacerations, hematomas and abrasions may be observed in bronchoscopy [6]. our patient had a formal endotracheal tube insertion bridging the two cut ends of the trachea, in the emergency treatment unit.

Airway rupture extending beyond the carina should be managed differently. Single lung ventilation is provided by inserting an endotracheal tube to the main bronchus opposite to the side of injury, under bronchoscopic vision. The injured side should be blocked by the insertion of a bronchial blocker. An intercostal tube is essential, to prevent the development of tension pneumothorax on that side. After the establishment of a secure airway, the patient can undergo further investigations

to decide on subsequent management. This will depend upon the mechanism and site of injury, and presence of associated injuries [6].

Symptoms and signs of laryngeal trauma such as hoarseness, stridor, haemoptysis, subcutaneous emphysema, loss of normal thyroid prominence, deviation of the larynx, loss of laryngeal crepitus and external injuries to the neck should be assessed as part of a secondary survey [4]. For stable patients imaging and diagnostics include CT imaging, flexible laryngoscopy, direct laryngoscopy and tracheoscopy [4].

Injury to the great vessels following penetrating injury will be indicated by a haemodynamically unstable patient with either external bleeding from the wound or expanding haematoma of the neck. Distal pulses and presence of bruits should be checked in patients with neck injuries. Angiography can be done even in stable patients prior to exploration where significant damage to vessels is suspected [4]. Injuries to the upper digestive tract present as bleeding from the mouth, drooling, and subcutaneous emphysema. Contrast-enhanced study of the upper tract will confirm this further. [4]. Our patient did not have any clinical evidence of major vascular or upper digestive injuries.

Indications for mandatory exploration of the neck following penetrating neck trauma are expanding haematoma, active bleeding from the wound, haemodynamic instability and hard aerodigestive signs such as bubbling, hoarseness and salivary fistula [4]. Other patients, following appropriate investigations to exclude injuries, can be safely observed. Our patient had hard signs of tracheal injury and underwent exploration.

The use of firecrackers as a tool to scare off animals has detrimental effects such as near mortality as in this case. Commonly seen injuries are ocular and upper limb injuries. Penetrating injuries to the neck is rather uncommon. Adherence to safety measures when using explosives cannot be overemphasized. It is the duty and responsibility of the health care workers to bring to light such cases as a measure to prevent this happening in the future. It is also the duty of the officials to control these practices by farmers and propose alternative solutions.

Conclusions

Firecrackers used by farmers to wade off animals can cause near-fatal injuries to the neck and measures should be taken to alleviate this practice and find alternative solutions. However such injuries should be managed promptly and actively to be life-saving.

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.

References

1. Pandurangarao SU, Basavaraj P, Yempalle SB, Karnam L. Primary Management and Outcome – Open Laryngotracheal Trauma. *Journal of Clinical and Diagnostic Research : JCDR*. 2017;11(2):MR01-MR04. <https://doi.org/10.7860/JCDR/2017/24155.9321>.
2. Schaefer S D. The acute management of external laryngeal trauma. A 27-year experience. *Arch Otolaryngol Head Neck Surg*. 1992 Jun;118(6):598-604.
3. Varghese A. Penetrating Neck Injury: A Case Report and Review of Management. *The Indian Journal of Surgery*. 2013;75(1):43-46. <https://doi.org/10.1007/s12262-012-0531-7>.
4. Schaefer, S. D. (2014), Management of acute blunt and penetrating external laryngeal trauma. *The Laryngoscope*, 124: 233–244. doi:10.1002/lary.24068
5. Gupta B, Gulati A, Gupta D. A Rare Presentation of Pellet Injury in the Neck. *ISRN Surgery*. 2011;2011:306126. . <https://doi.org/10.5402/2011/306126>.
6. Philicia Moonsamy, Uma M. Sachdeva, and Christopher R. Morse Management of laryngotracheal trauma *Ann Cardiothorac Surg*. 2018 Mar; 7(2): 210–216.

Learning Points:

- Firecracker blast can cause unusual injuries such as laryngotracheal injuries
- Prompt emergency management can save lives
- Society should be educated about the dangers of firecrackers

Perforated non Meckelian jejunal diverticulum : a rare cause of acute abdomen

J. P. Rankothkumbura, G. M. K. Bogammana
District General Hospital, Kegalle, Sri Lanka

Keywords: Jejunal diverticulum; acute abdomen; exploratory laparotomy

Introduction

Jejunal diverticulosis is a rare condition. Most of the affected patients are asymptomatic though some can present with acute abdomen due to various complications requiring intervention. We describe a patient who was managed successfully with emergency laparotomy due to a perforated jejunal diverticulum.

Case presentation

A 68-year-old previously healthy male presented to the emergency department with acute generalized abdominal pain and 3 episodes of non-bilious vomiting for 8 hours duration. He denied any past episodes of abdominal pain or any other symptoms leading towards a diagnosis except a two-week history of Non-steroidal anti-inflammatory drug use for joint pains. On examination, he was afebrile, but tachycardic (pulse rate 100 bpm) with the blood pressure of 110/70mmHg. Abdominal examination revealed generalized guarding and rigidity with loss of liver dullness on percussion. His abdominal X-ray was unremarkable but erect chest X-ray revealed air under the diaphragm (Figure 1). The full blood count showed mild leukocytosis (WBC-13.5*10⁹/L, Neutrophils – 72%) and was otherwise normal. Urgent ultrasound scan of the abdomen revealed the moderate amount of free fluid in the peritoneal cavity, but no other obvious pathological focus. Emergency laparotomy was planned with a provisional diagnosis of perforated peptic ulcer considering available findings. The laparotomy revealed multiple jejunal diverticula along the mesenteric border extending from duodenojejunal flexure to 60cm length of jejunum and a pinhole perforation of one of the diverticulum closer to the duodenojejunal flexure causing gross contamination of the peritoneal cavity (Figure 2). The diverticula bearing segment was excised and end to end anastomosis of small bowel was done in interrupted single layer seromuscular technique with 2/0 Polydioxane.

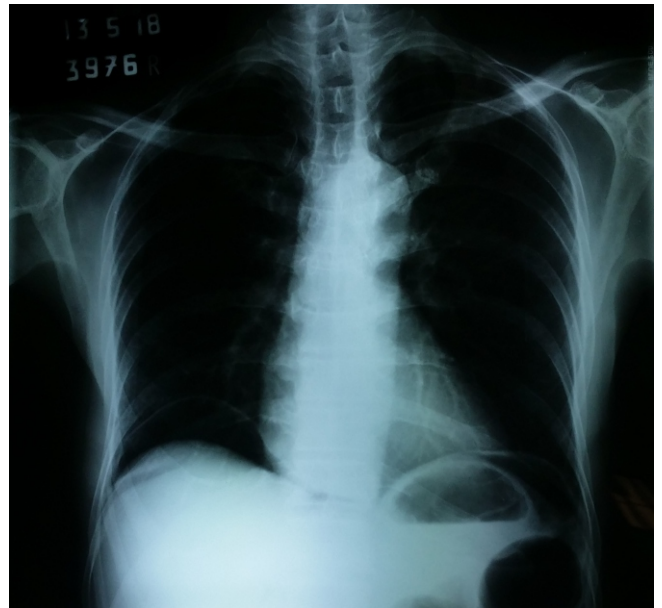


Figure 1. X-ray showing air under the diaphragm indicating pneumoperitoneum

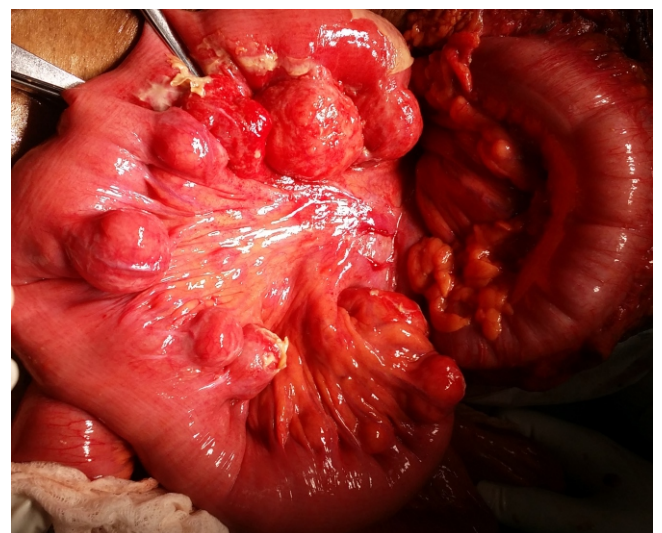



Figure 2. Multiple jejunal diverticula - intra-operative view

A coexisting uncomplicated Meckel's diverticulum was also found. It was excised and the defect was primarily repaired transversely. The abdomen was thoroughly lavage with warm normal saline and mass closure done. Post-operative period was uneventful except for superficial surgical site infection. Histopathology confirmed multiple jejunal diverticula with

Correspondence: G. M. K. Bogammana

E-mail: gmk.boga@gmail.com

Received: 16-11-2018 Accepted: 18-12-2018

 <https://orcid.org/0000-0001-9109-4986>

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intact mucosa and a thin muscle wall with a focus of acute suppurative inflammation and haemorrhage at the site of perforation.

Discussion and Conclusions

Non-Meckelian jejunal diverticula are a rare pathology. Reported studies state an incidence of 0.5- 2.3% in contrast studies and 0.3- 4.5% in postmortems [1]. More than 80% of the diagnosed patients are older than 60 years though the condition has been reported in less than 10 years old in the literature [2, 3]. They are considered acquired lesions and are mostly found in the mesenteric border in contrast to Meckel's diverticula. Two pathological types are described. One type has a narrow neck with absent or thin muscular layer while the other type has a wide neck with all layers of the gut wall but with thinning and fibrosis of the muscle layer [3].

While most patients remain asymptomatic, about 20-30% may develop chronic non-specific symptoms such as nausea, vomiting, abdominal pain and fullness. Malabsorption may develop secondary to stasis and bacterial overgrowth. Diverticulitis, bleeding, perforation, intestinal obstruction occur rarely causing acute abdomen. Jejunoileal diverticula are more likely to cause complications compared to duodenal diverticula [3, 4]. Rarely, carcinoma of jejunal diverticula has also been reported in the literature [2]. A focal inflammatory mass in contrast enhanced CT may usually show jejunal diverticulitis though loco- regional complications and severity defines the complete picture [5]. Enteroclysis is the best imaging modality for diagnosis. In acute presentations scintigraphy and angiography (for bleeding), x-ray abdomen with erect chest x-ray and an ultrasound scan of the abdomen (for obstruction and perforation) are useful in achieving a

diagnosis. Chronic symptoms are usually well managed conservatively by measures such as antibiotics for bacterial overgrowth. Acute presentations generally require surgical intervention. Most of the time resection of the pathological segment with a primary end to end anastomosis is recommended as in our patient with successful outcomes [1, 3].

Since this is a rare condition accurate diagnosis may be not be made until laparotomy. However jejunal diverticula must be considered as a differential diagnosis in acute or chronic presentations.

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.

References

1. Zager J S, Garbus J E, Shaw J P, Cohen M G, Garber S M. Jejunal Diverticulosis: A Rare Entity with Multiple Presentations, a Series of Cases. *Dig Surg*. 2000;17(6):643–5. <https://doi.org/10.1159/000051978>
2. Benson R E, Dixon C F, Waugh J M. NONMECKELIAN DIVERTICULA OF THE JEJUNUM AND ILEUM. *Ann Surg*. 1943 Sep;118(3):377–93. <https://doi.org/10.1097/0000658-194309000-00006>
3. marsik.pdf [Internet]. [cited 2018 Jul 1]. Available from: <http://www.pro-fovia.org/files/1/2006/2/marsik.pdf>
4. Akhrass R, Yaffe M B, Fischer C, Ponsky J, Shuck J M. Small-bowel diverticulosis: perceptions and reality. *J Am Coll Surg*. 1997 Apr;184(4):383–8.
5. CT features of jejunal pathology - Clinical Radiology [Internet]. [cited 2018 Jul 1]. Available from: [https://www.clinicalradiologyonline.net/article/S0009-9260\(07\)00206-1/fulltext](https://www.clinicalradiologyonline.net/article/S0009-9260(07)00206-1/fulltext)

Learning Points:

- Jejunal diverticula are a rare pathology with various presentations with both acute and chronic symptoms and signs.
- Acute complicated jejunal diverticula can be successfully managed with resection of affected segment and a primary end to end anastomosis.

Cephalic arch stenosis masquerading as carotid jugular arteriovenous fistula with a thrill in the neck

Syaiful Azzam bin Sopandi

Department of General Surgery, Hospital Kuala Lumpur, Malaysia

Keywords: Thyroglossal duct cyst; papillary carcinoma; thyroidectomy

Introduction

Autogenous arteriovenous fistulae creation (AVFs) is the gold standard technique for permanent haemodialysis access. However, AVF stenosis is a common problem and a major cause of fistula dysfunction. Juxta-anastomotic stenosis is the most frequent reason for AVF dysfunction. In brachiocephalic AVF, type 3 stenosis have been identified in up to 40% of failing fistulae [2]. Due to their location in the most proximal portion of the cephalic vein, they are also called cephalic arch stenosis (CAS). CAS remains a major problem among these patients and they may present to the clinician with a diverse symptom.

Case presentation

A 38-year-old lady, ESRF for 1 year, presented with a complaint of thrill sensation in the right side of her neck for 1 month duration. It was started as bruit noise that she heard, which progressed into a palpable thrill. In the earlier period of her hemodialysis history, she has been dialysed via right internal jugular double lumen catheter. A fistula was then created and eventually has been using the fistula for the hemodialysis ever since.

On clinical examination, her right brachio-cephalic fistula (BCF) was functioning well with a palpable thrill. There was no associated upper limb swelling. There was no facial swelling and no other prominent dilated neck and upper chest vein were observed. There was a palpable thrill at her base of the neck on the right side.


Duplex ultrasound was then carried out, but no obvious fistulation seen between these 2 vessels. A CTA of the carotid and base of the neck was then carried out (Figure 1).

A diagnostic central venogram revealed short stenosis at the cephalic arch region (Figure 2). No evidence of central venous occlusion.

Correspondence: Syaiful Azzam bin Sopandi

E-mail: zam_posse@yahoo.com

Received: 06-09-2018 Accepted: 05-10-2018

 <https://orcid.org/0000-0002-2589-4712>

DOI: <http://doi.org/10.4038/sljs.v36i4.8560>



The lesion was plastered with 6mm balloon and the symptom resolved immediately and she was discharged home on the same day and no immediate issue was observed during her dialysis.



Figure 1. CTA carotid. Observed the dilated right internal jugular vein, with no demonstrated fistula seen with the carotid (no contrast flow seen in the right IJV)



Figure 1. Venogram cannulated from the right BCF. Noted a stenosis near the cephalic arch

Discussion

The cephalic arch is part of the cephalic vein in the shoulder, which traverses the deltopectoral groove then passes below the clavicle bone before it joins the axillary vein. Stenosis of the cephalic arch is a common feature in the failure of brachiocephalic fistulas among end stage renal failure (ESRF) patient. Among these patients, the cephalic arch is

particularly susceptible to develop venous stenosis [3]. Pathophysiology of cephalic arch stenosis is likely multifactorial. The cephalic arch vulnerability to stenosis is thought to be due to an anatomic location in the deltopectoral groove thus limiting remodelling, angulation of the vein, and unfavourable shear stress related to increased blood flow [2]. The anatomy of the arch itself may give rise to turbulent flow causing high wall shear stress that promotes endothelial proliferation, vasoconstriction, and platelet aggregation. Venous valves located in the cephalic arch when exposed to high blood flows can hypertrophy, leading to a significant reduction in the luminal diameter of the vein. Failure of a vessel to dilate in the face of intimal hyperplasia will result in narrowing of the venous lumen and to obstruction of blood flow [2].

The delay in making a diagnosis for this particular case mainly contributed for the delay in the assessment of searching for the anatomical location of the possible fistula that was previously believed as a result of traumatic catheterization of the right internal jugular vein. The patient also did not have any other accompanying symptoms such as low flow fistula output, a problem during the hemodialysis such as having high venous pressure pump and other mild associated symptom such as prolonged bleeding from the puncture site, arm pain, or arm swelling. With such asymptomatic condition, one may miss the real problem that the patient had.

The thrill that appears and palpable on the right side of the base of the neck, may be contributed by the violent turbulence flow generated by the tight stenosis at the cephalic arch. This was indeed also causing dilatation of the right internal jugular vein that can be clearly seen in the initial CTA of the neck region.

The true aetiology of how the cephalic arch stenosis occurs still remains unknown. Although many have pointed towards the anatomical site of the vein, the angulation involved and the presence of venous valve system that may contribute to the development of high flow at this region and later intimal hyperplasia of that venous segment and narrowing of the lumen [3]. Percutaneous balloon venoplasty has generally been the initial treatment option for venous stenosis and is

considered to be the standard of care. However, the cephalic arch stenosis is frequently resistant to balloon venoplasty, requiring multiple venoplasty procedures in the future [1]. The use of the higher-pressure balloon is also often necessary, rendering the vessel susceptible to rupture. Lack of optimal venoplasty outcomes has to lead to the use of intravascular stent placement to be used for the treatment of cephalic arch stenosis [1]. Recurrent stenosis can occur within the stent and may lead one to consider a surgical option such as vein patch repair and transposition of the cephalic vein to axillary or subclavian vein to manage this lesion.

Conclusion

CAS is one of the long-term consequences of high flow rates fistula such as brachio-cephalic fistula. CAS must be one of the differential diagnosis in a patient presented with a thrill in the neck region. A long term follow up is mandatory in order to observe for early onset of recurrent stenosis and whether other surgical options as stated above are worth-doing in order to keep the fistula patent.

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.

References

1. Robert G Jones, Andrew P Willis, Karen Tullet. Results of Stent Graft Placement to Treat Cephalic Arch Stenosis in Hemodialysis Patients with Dysfunctional Brachiocephalic Arteriovenous Fistulas. *J of Vas Intervent Rad: JVIR*, 2017, 28 (10): 1417-1421 <https://doi.org/10.1016/j.jvir.2017.06.023>
2. Rachid Daoui, Arif Asif. Cephalic arch stenosis: mechanism and management strategies. *Seminars in Nephrology*, 2012, 32 (6):538-44 <https://doi.org/10.1016/j.semnephrol.2012.10.004>
3. Gajan Sivananthan, Leo Menashe, Neil J Halin. Cephalic arch stenosis in dialysis patients: review of clinical relevance, anatomy, current theories on etiology and management. *Journal of Vascular Access*, 2014, 15 (3), 157-62 <https://doi.org/10.5301/jva.5000203>
4. Himanshu V Patel et al. Carotid-jugular arteriovenous fistula: a case report of an iatrogenic complication following internal jugular vein catheterization for vascular access. *Hemo Inter*, 2011, 15 (3):404-6 <https://doi.org/10.1111/j.1542-4758.2011.00556.x>

Learning Points:

- CAS may be presented with diverse symptoms other than dysfunction fistula. Early recognition of these symptoms may help the clinician to intervene early.
- Immediate endovascular intervention may resolve such symptom that initially believed from a complicated complication of traumatic catheterization.
- A younger patient with BCF may develop CAS early in their dialysis life due to high flow characteristic of the fistula.

Neuropathic ulcer: rare manifestation of Eosinophilic granulomatosis with polyangiitis

P. Thineskaran, S. Pirasath, G. Selvaratnam, V. Perera.
Teaching Hospital Jaffna, Sri Lanka.

Keywords: Eosinophilic granulomatosis; polyangiitis; neuropathic ulcer

Introduction

Eosinophilic granulomatosis with polyangiitis (EGPA) is a small vessel, multisystem vasculitis associated with refractory bronchial asthma, eosinophilia, peripheral neuropathy and lung infiltrates. We report a case of EGPA presenting with bronchial asthma, non-healing neuropathic ulcer with polyneuropathy, eosinophilia, pulmonary infiltrates and eosinophilic tissue infiltrates on biopsy.

Case presentation

A 15-year-old girl presented with recurrent ulcer with sensory impairment on left hand for 6 months duration. She had progressive nodular skin lesions on left third finger for 8 months duration. She had poorly controlled childhood bronchial asthma since the age of 5 years. She had three life-threatening episodes, which was managed in the intensive care unit. She had bilateral polyphonic rhonchi on examination. She had an ulcer with sensory impairment on the extensor surface of the left hand with ulnar claw hand (Figure 1). Her complete blood count showed eosinophilia (6.3%) with normal other cell counts. Her inflammatory markers, liver and renal function were normal (CRP-1.9mg/L and ESR-n 26mm/1st hour). Her chest x-ray showed patchy opacities in the upper zones of both lungs. The patchy ground glass appearance was noted in high resolution of computed tomography. The skin punch biopsy showed necrotizing vasculitis, tissue eosinophilia and extravascular granulomata suggestive of EGPA. Her vasculitic screening (C-ANCA and P-ANCA) were negative. Her diagnosis was EGPA and she was managed with corticosteroids. She improved with therapy and was followed up at a medical clinic.

Discussion

EGPA is manifested by the late onset of asthma, and eosinophilic vasculitis of small- and medium-sized vessels [1]. It is defined as an eosinophil-rich and necrotizing

The lesion was plastered with 6mm balloon and the symptom resolved immediately and she was discharged home on the same day and no immediate issue was observed during her dialysis.



Figure 1. The poorly healing ulcer with sensory impairment on the extensor surface of left hand with ulnar


granulomatous inflammation [2], and necrotizing vasculitis associated with asthma and eosinophilia [3] according to the 2012 revised International Chapel Hill Consensus Conference Nomenclature of Vasculitides.

Our patient had asthma, peripheral eosinophilia, polyneuropathy, pulmonary infiltrates and eosinophilic tissue infiltrates, fulfilling the American College of Rheumatology criteria for EGPA [4]. The p-ANCA is positive among 40-60 % of patients with EGPA [5]. It was negative in our patient. The necrotizing vasculitis with eosinophilic infiltration in the vessels is the histopathological feature. Our patient had a histological feature of EGPA. The electrodiagnostic study showed confluent sensory-motor axonal mononeuropathy multiplex. Lung computed tomography (CT) scan showed patchy ground-glass opacity with a mosaic pattern. HRCT of our patient also suggestive for diagnosis of EGPA. Rapid diagnosis is necessary for management of ANCA-associated vasculitis and early initiation of immunosuppressants is mandatory for good clinical outcome [6]. She improved with systemic corticosteroids promptly and her wound healed completely and she did not have any exacerbations of bronchial asthma for last one year.

Correspondence: Selladurai Pirasath

E-mail: selladurairasath81@gmail.com

Received: 01-12-2018 Accepted: 21-12-2018

 <http://orcid.org/0000-0002-4274-4919>

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This case highlights that a common surgical presentation of a much less common systemic disease. Surgeons should be aware that nonhealing ulcer is the neurological manifestations of EGPA. Unhealing ulcer with marked peripheral eosinophilia, especially in patients with refractory asthma, should alert the clinician to the possibility of this rare disorder of EGPA.

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.

References

1. Greco A, Rizzo MI, De Virgilio A, Gallo A, Fusconi M, et al. Churg-Strauss syndrome. *Autoimmun Rev* 2015; 14: 341-8. <https://doi.org/10.1016/j.autrev.2014.12.004>
2. Marques CC, Fernandes EL, Miquelin GM, Colferai MM. Cutaneous manifestations of Churg-Strauss syndrome: key to diagnosis. *An Bras Dermatol* 2017; 92(5 Suppl 1):56-8.
3. Jennette JC, Falk RJ, Bacon PA, Basu N, Cid MC, et al. 2012 revised International Chapel Hill Consensus Conference Nomenclature of Vasculitides. *Arthritis Rheum* 2013;65: 1-11. <https://doi.org/10.1002/art.37715>
4. Masi AT, Hunder GG, Lie JT, Michel BA, Bloch DA, Arend WP et al. The American College of Rheumatology 1990 criteria for the classification of Churg-Strauss syndrome (allergic granulomatosis and angiitis). *Arthritis Rheum* 1990 ; 33(8):1094-100. <https://doi.org/10.1002/art.1780330806>
5. Villacorta J, Díaz - Crespo F, Stanescu R, Fernandez - Juarez G. Large and small vessel severe involvement in ANCA-associated vasculitis. *J Vasc*; 2: e105.
6. E. Ntatsaki, D. Carruthers, K. Chakravarty et al., "BSR and BHPR guideline for the management of adults with ANCA-associated vasculitis,". *Rheumatology*, 2014;53 (12): 2306-9. <https://www.ncbi.nlm.nih.gov/pubmed/24729399>. <https://doi.org/10.1093/rheumatology/ket445>

Learning Points:

- Non healing ulcer with marked peripheral eosinophilia, especially in patients with refractory asthma, should alert the surgeons to the possibility of this rare disorder of EGPA.

SELECTED ABSTRACT

Anatomic approximation approach to correction of transverse facial clefts

Raymond W.Tse, Robert J.Knight, David M Fisher. *J Plast Reconstr Aesthet Surg.* 2018; 71(11):1600-1608.

<https://doi.org/10.1016/j.bjps.2018.05.020>

Transverse clefts of the oral cavity have significant impacts on both appearance and function. Many methods of repair have been described, but there is no consensus on optimal approach. In addition, dissatisfaction with scars, distortion of appearance, and recurrent deformity have led to complex surgical designs that are difficult to understand and reproduce. We describe a simple approach to repair that is based upon anatomic approximation of lip components and accurate repair of the muscle.

Twenty patients underwent repair by the senior author, who devised the approach, and the corresponding author, who adopted it. Eight (62%) patients had right-sided clefts, three (23%) patients had left-sided clefts, and two (15%) patients had bilateral clefts. One patient had an associated branchial cleft remnant, two patients had multiple branchial cleft remnants and tragusdeformities, one patient had craniofacial microsomia with microtia, and one patient had a contralateral Tessier 1 cleft. Mean age of the patients at repair was 23 months. All patients achieved normal oral competence, have favorable scars and commissure appearance, and have had no recurrent deformity. None of the patients have required revision.

The described surgical approach is reproducible, easy to understand, and can produce favorable outcomes.

Commentary

Dr. Gayan Ekanayake

Consultant Plastic Surgeon,

Teaching Hospital Kurunagale,

Sri Lanka

This article is an article based on a surgical technique. The senior author has performed the surgery in twenty cases. Although there are many techniques to repair a transverse facial cleft, correcting all the elements of the cleft are not there in every technique.

This technique has addressed nearly all the anatomical factors including muscle arrangements at the corner of the mouth. Most important feature in the article is the long term followup of the result. The scar behavior, we feel is the most important factor for the patient satisfaction. Looking at the article the scars have settled very nicely.

Critical evaluation of the same outcome is very important in every skin type. Particularly the Sri Lankan skin behaves differently. Scar therapy is the crucial factor which can be added and tested in a future study that can be reformed in Sri Lanka.

Fracture prevention with Zoledronate in older women with osteopenia

Ian R. Reid, M.D., Anne M. Horne, M.B., Ch.B., Borislav Mihov, B. Ph.D., Angela Stewart, R. N., Elizabeth Garratt, B.Nurs., Sumwai Wong, B.Sc., Katy R. Wiessing, B.Sc., Mark J. Bolland, Ph.D., Sonja Bastin, M.B., Ch.B., Gregory D. Gamble, M.Sc.

N Engl J Med 2018; 379:2407-2416,

DOI: 10.1056/NEJMoa1808082; December 20, 2018

Methods

Six years double blind study on 2000 women with osteopenia (T Score -1.0 to -2.5) was conducted. Participants randomly assigned to two groups.

zoledronate group receiving four infusions zoledronate at a dose of 5 mg at 18-month and Placebo group receiving four infusions of normal saline at 18 months interval. All participants were women 65 years or older had a total hip or a femoral neck fracture. All participants advised 1g calcium and Vitamin D before the trial and during the trial. The primary end point was the time to first occurrence of a non-vertebral or vertebral fragility fracture.

Results

As compared with the placebo group, women who received zoledronate had a lower risk of non-vertebral fragility fractures (hazard ratio, 0.66; P=0.001), symptomatic fractures (hazard ratio, 0.73; P=0.003), vertebral fractures (odds ratio, 0.45; P=0.002), and height loss (P<0.001).

Conclusions

The risk of non-vertebral or vertebral fragility fractures was significantly lower in women with osteopenia who received zoledronate than in women who received placebo.

Commentary

Hiran Amarasekera

Consultant Orthopaedic Surgeon,

Neville Fernando Teaching Hospital

Malabe, Sri Lanka

There is clear evidence to say the Bisphosphonates prevent fragility fractures in patients with osteoporosis. Hence the

recommendation to treat osteoporosis and secondary prevention of fragility fractures with bisphosphonates in women with osteoporosis. How ever does bisphosphonates have a role in preventing early osteopenia thus preventing fragility fracture rates in women? A question that needs a clear answer in modern day osteoporosis management but not has been addressed well in the past. Ian R. Reid et al with a randomized control trial tries to answer the question. They have managed to clearly formulate the question select the groups randomized and obtain the results with a statistically significant difference between the two groups. This article suggests that we should start using bisphosphonates as early as when osteopenia sets in and current guidelines of using bisphosphonates may have to be revised. However it is also worth noting that this study is on treatment of IV bisphosphonate Zoledronate and whether these results can be transferred to the oral counterparts such as Alendronates is another concern that needs to be addressed.

1. Reid IR, Horne AM, Mihov B, et al. Fracture Prevention with Zoledronate in Older Women with Osteopenia. *N Engl J Med* 2018;379:2407-16.
2. Clinical guideline for the prevention and treatment of osteoporosis. In: Group NOG, ed. 2 ed. Uk2017.

A most odd ratio: interpreting and describing odds ratios

Alexander Persoskie, PhD and Rebecca A. Ferrer, PhD
American Journal of Preventive Medicine
2017;52(2):224–228
<https://doi.org/10.1016/j.amepre.2016.07.030>

Introduction

The OR is one of the most commonly used measures of association in preventive medicine, and yet it is unintuitive and easily misinterpreted by journal authors and readers.

Methods

This article describes correct interpretations of ORs, explains how ORs are different from risk ratios (RRs), and notes potential supplements and alternatives to the presentation of ORs that may help readers avoid confusion about the strength of associations.

Results

ORs are often interpreted as though they have the same meaning as RRs (i.e., ratios of probabilities rather than ratios of odds), an interpretation that is incorrect in cross-sectional and longitudinal analyses. Without knowing the base rate of the outcome event in such analyses, it is impossible to evaluate the size of the absolute or relative change in risk associated with an OR, and misinterpreting the OR as an RR leads to the overestimation of the effect size when the outcome event is common rather than rare in the study sample. In case-control analyses, whether an OR can be

interpreted as an RR depends on how the controls were selected.

Conclusions

Education, peer reviewer vigilance, and journal reporting standards concerning ORs may improve the clarity and accuracy with which this common measure of association is described and understood in preventive medicine and public health research.

Commentary

Dr. Rasika Jayatillake
Senior Lecturer, Department of Statistics,
Faculty of Science, University of Colombo.

Odds ratio is a common statistic used to measure the association between a disease and an exposure factor. It is also the statistic provided in logistic regression which is fitted to binary outcome i.e. a case or control. However, it is often misinterpreted or confused with relative risk as interpretation of risk is much more intuitive than odds. And at the same time many researchers fail to understand the difference of risk and odds and the consequences of such misinterpretations. Authors of this article explains important differences and aspects of odds ratio and relative risk using 3 hypothetical scenarios. Readers are given a comprehensive explanation of how odds and risks are interpreted correctly and circumstances when they mean the same and how changing the way cases and controls are selected could influence the interpretations. As odds ratios are the common statistics in logistic regression authors also suggests with possible alternatives to logistic model which would provide with risk instead of odds.

Long-term outcomes of coil embolization of unruptured intracranial aneurysms

Masaomi Koyanagi , Akira Ishii, Hirotochi Imamura, Tetsu Satow, Kazumichi Yoshida, Hitoshi Hasegawa, Takayuki Kikuchi, Yohei Takenobu, Mitsushige Ando, Jun C. Takahashi, Ichiro Nakahara, Nobuyuki Sakai and Susumu Miyamoto
Journal of Neurosurgery. 2018; 129 (6):1377-1662

Objective

Long-term follow-up results of the treatment of unruptured intracranial aneurysms (UIAs) by means of coil embolization remain unclear. The aim of this study was to analyze the frequency of rupture, retreatment, stroke, and death in patients with coiled UIAs who were followed for up to 20 years at multiple stroke centers.

Method

The authors retrospectively analyzed data from cases in which patients underwent coil embolization between 1995

and 2004 at 4 stroke centers. In collecting the late (≥ 1 year) follow-up data, postal questionnaires were used to assess whether patients had experienced rupture or retreatment of a coiled aneurysm or any stroke or had died.

Results

Overall, 184 patients with 188 UIAs were included. The median follow-up period was 12 years (interquartile range 11–13 years, maximum 20 years). A total of 152 UIAs (81%) were followed for more than 10 years. The incidence of rupture was 2 in 2122 aneurysm-years (annual rupture rate 0.09%). Nine of the 188 patients with coiled UIAs (4.8%) underwent additional treatment. In 5 of these 9 cases, the first retreatment was performed more than 5 years after the initial treatment. Large aneurysms were significantly more likely to require retreatment. Nine strokes occurred over the 2122 aneurysm-years. Seventeen patients died in this cohort.

Conclusion

This study demonstrates a low risk of rupture of coiled UIAs with long-term follow-up periods of up to 20 years. This suggests that coiling of UIAs could prevent rupture for a long period of time. However, large aneurysms might need to be followed for a longer time.

Commentary

Dr. Ruvini Abeygunaratne
Consultant Neurosurgeon

The use of coil embolization (coiling) of aneurysms has now established itself firmly in the management of aneurysms in neurosurgical practice. But there is still discussion with regards to the long term outcome of coiling. Since the ISAT trial we can firmly say that coiling is here to stay. This is also an ongoing discussion amongst the neurosurgeons who are keen to surgically treat the aneurysms and the interventional neuroradiologists who wish to coil. Both parties fighting their corner vigorously. This is yet another study which reports the safety of coiling in unruptured aneurysms. In my opinion as a neurosurgeon I firmly believe there is a role to play by both modes of treatment. Not all aneurysms can be coiled but all aneurysms can be clipped. I would prefer in acute aneurysm rupture that coiling is considered if possible to avoid a craniotomy at a time when the brain is less forgiving. The patient should have the best option for them determined after discussion between the specialities to give the patient the best outcome possible. In this study the retrospective data demonstrates the low risk factors associated with coiling of unruptured aneurysms but of note the aneurysms were small in size.

When considering coiling in Sri Lanka unfortunately the cost has a huge impact as it is still significantly higher compared to clipping. Therefore it is essential that surgical trainees

continue with the training in clipping for the foreseeable future. This is a major problem in Western countries due to subspecialisation within specialities. The skill of clipping is being lost due to a combination of subspecialisation and coiling being freely available. This will be a problem in the future as there may not be the available surgical skills to clip the complex, large and uncoilable aneurysms as well as dealing with the problems arising from failure of coiling.

Correspondence

Re: "A case of Midgut malrotation presenting as sub-acute intestinal obstruction in an adult"

Original article: Mathangasinghe, Y. and Samaranayake, U.M.J.E., 2018. A case of midgut malrotation presenting as subacute intestinal obstruction in an adult. *Sri Lanka Journal of Surgery*, 36(1), pp.47–48.

DOI: <http://doi.org/10.4038/sljs.v36i1.8485>

Published on 30 Apr 2018.

To the editor:

I read with interest the article "A case of Midgut malrotation presenting as sub-acute intestinal obstruction in an adult" in the April issue of *The Sri Lanka Journal of Surgery*.

As a paediatric surgeon I would like to point out certain shortcomings in the article which are as follows.

- (1) The authors have mentioned that the 3rd part of the duodenum was atretic. In medical terms atresia means a congenital absence or a complete closure of a tubular structure. This is almost impossible in this patient as he was 68 years of age and had presented only with intermittent symptoms suggestive of partial intestinal obstruction and the upper GI contrast study also clearly shows the contrast in the distal small bowel. What generally happens in malrotation is an extrinsic compression of the 2nd part of the duodenum by the so called Ladd's bands leading to a partial obstruction.
- (2) The authors also mention that they did divide the bands which they called the Ladd's procedure which is again incorrect as the Ladd's procedure involves in addition,
 - (A) The straightening of the duodenum and
 - (B) The mobilization of the caecum to the left hypochondrium so that the base of the mesentery is widened which is the most important step thus minimizing the chance of a future twisting of the base of the mesentery.

The latter (The twist of the midgut) is the most dreaded complication of uncorrected malrotation with resultant midgut ischaemia/necrosis. According to the article this most

important part of the operation has not been carried out thus leaving the patient still with the potential risk of twisting of the midgut (midgut volvulus) and its sequelae. Had the complete Ladd's procedure been done, the gastrojejunostomy which was done in this patient would not have been required. Although the authors themselves have mentioned the fact that such a procedure as gastrojejunostomy done in this patient is required only rarely, no reference of any recorded instance of it being carried out for malrotation has been given. I feel that as a peer reviewed article these shortcomings should not have been overlooked before publication as this is the foremost journal of the surgical fraternity of Sri Lanka.

Yours sincerely,

Dr. B.A.D Jayawardhene

Consultant Paediatric Surgeon

Lady Ridgeway Hospital for Children

Authors reply:

We write back as a response to the letter to the editor. We appreciate the constructive criticism provided on the above article.

Duodenal atresia was defined in the Nelson textbook of paediatrics as: "Atresia occurs in several forms. One or more segments of bowel may be missing completely, there may be varying degree of obstruction caused by webs or stenosis, or there may be obliteration of the lumen in cord like bowel remnants"[1]. What we meant by an "atretic segment" was a partially obstructed segment of the duodenum.

Ladd's procedure was first described by William Ladd in 1936 [2]. The classical Ladd's procedure comprised of four steps: division of Ladd's bands which compresses the duodenum; widening of the of the root of the mesentery by mobilising the duodenum and division of the adhesions around the superior mesenteric artery to prevent further volvulus; counter-clockwise detorsioning of the midgut volvulus if present and appendicectomy to prevent future diagnostic dilemma of an abnormally located appendix [2]. A literature review on adult midgut malrotation stated the following verbatim: "The original Ladd's procedure was described for the paediatric population group and the full components of this procedure may not be offered in the adult group" [3]. It is also accepted that "untwisting of the duodenum from the posterior capsule of the pancreas can be difficult and is a technique not often used in adult surgery" [4]. A case report based on surgical correction of an adult midgut malrotation conducted in Queen Mary's hospital, London, UK and which was published in World Journal of Emergency Surgery stated following verbatim "We offered a modified procedure to our patient by performing a division of Ladd's bands and an appendicectomy. There was no volvulus and we did not feel that the

duodenum needed to be mobilised and straightened in this case. Our patient has been completely symptom free during 12 months of follow up" [3]. Thus, straightening of the duodenum can be conducted as an elective procedure depending on the intraoperative findings, not as a mandatory procedure. In our patient, division of Ladd's bands was performed along with the widening of the root of the mesentery. But the straightening of the duodenum was not done. The procedure carried out by us was a modification of the original Ladd's procedure.

In the present case, intravenous Omnipaque, oral and rectal contrast CT scan with sagittal and coronal reconstructions did not show extrinsic compression. It was concluded that there was intrinsic obstruction of the second part of the duodenum. Small intestine was not filled with contrast in the CT implying that this was a significant obstruction. The intraoperative findings showed Ladd's bands. Even after the division of Ladd's bands, the lumen seemed to be narrow. Milking of the contents of the proximal part of the duodenum to the distal part through the narrowing was difficult even after the division of Ladd's bands. This might be because of narrowing due to long standing external compression from the Ladd's bands. Due to this persistent narrowing, a diversion gastrojejunostomy was performed to prevent recurrence. A similar procedure of Ladd's band division, mesenteric base widening, and gastrojejunostomy without straightening of the duodenum as a treatment for adult malrotation and chronic obstruction has been previously reported and published in a peer reviewed journal [5].

References

1. Marcante, K. J., & Kliegman, R. (2015). Intestinal atresia, Nelson essentials of pediatrics (7th edition.), Philadelphia: Elsevier/Saunders, section 17, 438-439
2. Ladd WE: Surgical diseases of the alimentary tract in infants. N Engl J Med 1936, 215:705-708.
3. Emanuwa OF, Ayantunde AA, Davies TW. Midgut malrotation first presenting as acute bowel obstruction in adulthood: a case report and literature review. World Journal of Emergency Surgery. 2011 Dec;6(1):22.
4. Escobar MA, Ladd AP, Grosfeld JL, West KW, Rescorla FJ, Scherer III LR, Engum SA, Rouse TM, Billmire DF. Duodenal atresia and stenosis: long-term follow-up over 30 years. Journal of pediatric surgery. 2004 Jun 1;39(6):867-71.
5. Nivash.S. "Adult Midgut Malrotation-An Unusal Case Report." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 16.8 (2017): 01-04

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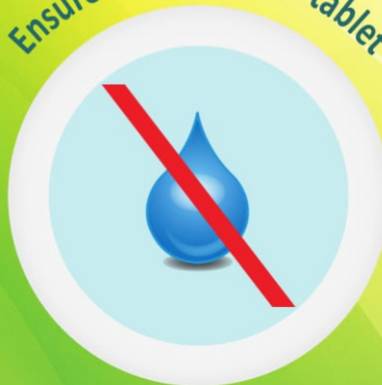


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