Volume 45 Number 3
July - September 2024

ISSN 0125-6068
E-ISSN 2697-5858

THE THAI JOURNAL OF SURGERY

TJS

Official Publication of The Royal College of Surgeons of Thailand

EDITORIAL

ORIGINAL ARTICLES

CASE REPORTS

ABSTRACTS

https://he02.tci-thaijo.org/index.php/ThaiJSurg/index

The Royal College of Surgeons of Thailand

Secretariat Office :
Royal Golden Jubilee Building, 2 Soi Soonvijai, New Petchburi Road,
Bangkok 10310, Thailand

OFFICERS 2023 - 2025

President	:	**Apirag Chuangsuwanich**
President-Elect	:	**Thanyadej Nimmanwudipong**
Vice President	:	**Vitoon Chinswangwatanakul**
Secretary General	:	**Pornchai O-charoenrat**
Assistant Scretary	:	**Chumpol Wongwanit**
Treasurer	:	**Srila Samphao**
Members	:	**Kaweesak Chittawatanarat**
		Asada Methasate
		Anon Chotirosniramit
Past Presidents	:	**Udom Poshakrisna**
		Sem Pring-Puang-Geo
		Kasarn Chartikavanij
		Charas Suwanwela
		Thira Limsila
		Kijja Sindhvananda
		Arun Pausawasdi
		Kitti Yensudchai
		Thongueb Uttaravichien
		Chomchark Chuntrasakul
		Prinya Sakiyalak
		Vithya Vathanophas
		Naronk Rodwarna
		Nopadol Wora-Urai
		Soottiporn Chittmittrapap
		Vajarabhongsa Bhudhisawasdi
		Parinya Thavichaigarn
		Tanaphon Maipang
		Paisit Siriwittayakorn
		Pramook Mutirangura

BOARD OF DIRECTORS

General Surgeons	**Thawatchai Akaraviputh**
Pediatric Surgeons	**Pornsri Thanachatchairattana**
Plastic & Reconstructive Surgeons	**Apichai Angspatt**
Thoracic Surgeons	**Teerachat Silarat**
Neurosurgeons	**Kullapat Veerasarn**
Urological Surgeons	**Vorapot Choonhaklai**
Colorectal Surgeons	**Boonchai Ngamsirimas**
Orthopedic Surgeons	**Apisit Patamarat**
Vascular Surgeons	**Chanean Ruangsetakit**
Trauma Surgeons	**Narain Chotirosniramit**
Oncology Surgeons	**Wichai Vassanasiri**

The THAI *Journal of* SURGERY

Official Publication of The Royal College of Surgeons of Thailand

ISSN 0125-6068
E-ISSN 2697-5858

Editorial Board

Published quarterly by : The Royal College of Surgeons of Thailand

The THAI
Journal of SURGERY

Official Publication of The Royal College of Surgeons of Thailand

Author Guidelines

About the Journal

The Thai Journal of Surgery is the official publication of The Royal College of Surgeons of Thailand and is issued quarterly.

The Thai Journal of Surgery invites concise original articles in clinical and experimental surgery, surgical education, surgical history, surgical techniques, and devices, as well as review articles in surgery and related fields. Papers in basic science and translational medicine related to surgery are also welcome.

Aim & Scope

The Thai Journal of Surgery is dedicated to serving the needs of the members of The Royal College of Surgeons of Thailand, specifically the younger researchers and surgical trainees who wish to have an outlet for their research endeavors. The Royal College strives to encourage and help develop Thai Surgeons to become competent researchers in all their chosen fields. With an international outlook, The Thai Journal of Surgery welcomes submissions from outside of Thailand as well.

Copyright Notice

Articles must be contributed solely to The Thai Journal of Surgery and when published become the property of The Royal College of Surgeons of Thailand. The Royal College of Surgeons of Thailand reserves copyright on all published materials and such materials may not be reproduced in any form without written permission.

Manuscripts submitted for publication should be sent via online submission through https://he02.tci-thaijo.org/index.php/ThaiJSurg/about/submissions.

Manuscripts

Manuscripts should be in the Microsoft Word Document format (.doc or .docx) only, with double spacing and 2.54 cm margins. The font used for the main text should be 12 pt. Times New Roman. Separate pages: title and abstract page, full paper, acknowledgments, references, individual tables, abstract in Thai (optional), and legends. Number pages consecutively, beginning with the title and abstract page. Type the page number in the footer of each page (center alignment). Metric measurements should be used. Generic names for drugs should be used and if trade name is mentioned, it should be put in parenthesis.

The title and abstract page of the manuscript should be typed on a separate sheet and should contain the following information:

1. Title of the paper
2. Full name of Author(s), with academic degree(s)
3. Name of department and institution to which the author is affiliated.
4. Abstract should not exceed 300 words.
5. At least 3 keywords
6. Corresponding author or principal contact for editorial correspondence
7. Short running title and sources of funding, if any
8. Declaration that the manuscript has been proofread by the Journal's recommended Proofreading Service

Illustrations and Tables

All photographs and original drawings should be professionally made or drawn and uploaded as jpeg, png, tiff files with at least 300 ppi resolution. Typewritten or freehand lettering is not acceptable. The illustration should be numbered along with an appropriate description (legend/caption). Each table should be prepared on a separate sheet and should be numbered consecutively as mentioned in the text and each must have a title. All tables should be typed directly on the page using the table function in Microsoft Word and not copied and pasted. All columns must be in separated cells, but related rows in any column can be in the same cell. Otherwise, it is best to have 1 cell per item (name or number). Abbreviations in the table must be defined, either in the table or in a footnote to the table. See a concise example in the Journal's website.

References

References must be listed on a separate sheet in numeric order as referred to in the article, not alphabetically. A simplified Vancouver system is used. Only references mentioned in the text should be listed and should be selective with no more than 30 references except under unusual circumstances. Number references consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals (in superscript). The references must be verified by the author(s) against the original documents. Example forms of references are given below.

1. Standard Journal Article:

List all authors when three or less; when four or more, list only the first three and add et al.

- Soter NA, Wasserman SI, Austen KF. Cold urticaria: release into the circulation of histamine and eosinophil chemotactic factor of anaphylaxis during cold challenge. N Engl J Med 1976; 294:687- 90.

2. Corporate Author:

- The Committee on Enzymes of the Scandinavian Society for Clinical Chemistry and Clinical Physiology. Recommended method for the determination of gamma glutamyltransferase in blood. Scand J Clin Lab Invest 1976; 36:119-25.
- American Medical Association Department of Drugs. AMA drug evaluations. 3rd ed. Littleton: Publishing Sciences Group, 1977.

3. Personal Author(s):

- Osler AG. Complement: mechanisms and functions. Englewood Cliffs: Prentice - Hall, 1976.

4. Editor, Compiler, Chairman as Author:

- Rhooder AJ, Van Rooyen CE, comps. Textbook of virology: for students and practitioners of medicine and the other health

sciences. 5th ed. Baltimore: Williams & Wilkins, 1968.

5. **Chapter in a Book:**
   - o Weinstein L, Swartz MN. Pathogenic properties of invading microorganisms. In: Sodeman WA Jr. Sodeman WA, eds. Pathologic physiology: mechanisme of disease. Philadelphia: WB Saunders, 1974:457-72.
6. **Agency Publication:**
   - o National Center for Health Statistics. Acute conditions: incidence and associated disability, United States, July 1968-June1969. Rockville. Md.: National Center for Health statistics, 1972. Vital and health statistics. Series 10: Data from the National Health Survey, No. 69: (DHEW publication no. (HSM) 72-1036).
7. **Newspaper Article:**
   - o Shaffer RA. Advances in chemistry are starting to unlock mysteries of the brain: discoveries could help cure alcoholism and inso mnia, explain mental illness. How trhe messengers work. Wall Street Journal 1977 Aug 12:(col. 1), 10(col.1).
8. **Magazine Article:**
   - o Roueche B. Annals of medicine: the Santa Claus culture. The New Yorker 1971 Sep 4:66-81. 9.
9. **The use of the article's Digital Object Identifier (DOI):**

An article can be referenced using only the DOI for electronic Journals and online articles or the DOI can be used in addition to standard referencing to print articles.

- o Chirappapha P, Arunnart M, Lertsithichai P, et al. Evaluation the effect of preserving intercostobrachial nerve in axillary dissection for breast cancer patient. Gland Surg 2019. doi:10.21037/gs.2019.10.06.
- o Chirappapha P, Arunnart M, Lertsithichai P, et al. Evaluation the effect of preserving intercostobrachial nerve in axillary dissection for breast cancer patient. Gland Surg 2019;8:599-608. doi:10.21037/gs.2019.10.06.

Abbreviations

Use only standard abbreviations of commonly used approved abbreviations. Avoid abbreviations in the title. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

Statistics

All statistical analyses and the statistical software used must be concisely described. Descriptive statistics for quantitative variables must include an appropriate central tendency measure (e.g., mean or median) as well as a corresponding measure of spread (e.g., standard deviation or range or interquartile range). Categorical variables must be summarized in terms of frequency (counts) and percentage for each category. Ordinal variables can be summarized in terms of frequency and percentage, or as quantitative variables when appropriate. Statistical tests must be named and p-values provided to 3 decimal places. P-values less than 0.001 should be written "< 0.001" and p-values approaching 1 should be written "0.999".

All statistical estimates (e.g., mean differences, odds ratios, risk ratios, hazard ratios, regression coefficients, and so on) must have corresponding 95% confidence interval limits. All statistical models used must be briefly described. Uncommon or unusual methods used should be referenced. Authors should refrain from over-modeling their dataset; for example, multivariable analyses of datasets with small sample sizes (e.g., < 100), or few outcomes (e.g. < 10), could be unreliable. Relative risks of categories in a categorical risk factor should be compared to its own reference category, which must be indicated, for example, in a table of multivariable analysis.

Randomized controlled trials should be analyzed using the intention-to-treat principle, and as treated analysis should be applied as well if there are significant cross-overs. Further details of statistical issues are available here (http://www.icmje.org/icmje-recommendations.pdf).

Standards of Reporting for Research Articles

Authors are advised that the Thai Journal of Surgery adheres to standards set by the International Committee of Medical Journal Editors (ICMJE) and the Committee on Publication Ethics (COPE). Reporting guidelines that authors should consult and follow include the CONSORT Guidelines for randomized controlled trials; PRISMA Guidelines for systematic reviews and meta-analyses of randomized controlled trials, MOOSE Guidelines for systematic reviews, and meta-analysis of observational studies; STROBE Guidelines for observational studies; and ARRIVE Guidelines for animal research. Details of these and other guidelines can be obtained from https://www.equator-network.org/reporting-guidelines/.

Common Format for Research Articles

(see Format https://bit.ly/3IaP4ZB)

Abstract: should be no more than 300 words in length, and written in a structured format, including the following headings: **Objective,** which can include some background material of 1 to 2 sentences in length, but mainly describing the research question; **Methods,** concisely describing the research design and data procurement; **Results,** describing the main findings of the study; and **Conclusion,** which should concisely answer the research question, and no more. Below the abstract, a list of keywords should be provided.

Main text: should be written in a structured format, including the following headings. **Introduction** should describe the rationale of the study within the context of current knowledge; the gap in knowledge with which the research study will fill must be clearly pointed out and a research question explicitly stated. **Methods (and patients, if applicable)** should clearly describe the details of research methodology and patient or research volunteer recruitment according to Guidelines for each type of research as listed above (…), and how the data was collected and analyzed. A short description of statistics used, and the software and references if appropriate, must be provided. A note on Ethics Committee approval, if applicable, must be given. **Results** should include data or summaries of patient or volunteer characteristics, summaries of risk factors or covariates and outcomes, presented in tabular, graphical or descriptions in the text as appropriate, without significantly duplicating one another. Results of statistical analyses must be clearly displayed and should include point estimates, standard errors, statistical tests, *p*-values, and 95% confidence intervals as detailed (…). Analyses not shown but referred to must not change the conclusions or outcomes. **Discussion,** which must fully describe the implications of the research results, should include a concise

literature review of previous published, related results. These related results must be compared with those of the authors' study, and the differences clearly stated along with plausible explanations. New unexpected findings, especially from subgroup analyses or those for which the research was not designed, should be considered hypothetical and stated as such. Any plausible, relevant clinical application should be indicated. Finally, any significant limitations of the study must be mentioned and possible extensions of research should be briefly provided. **Conclusion,** which should be concerned with answering the research question posed by the current study, should not be summarizing results of previous studies or recommendations. An **Acknowledgement** section can be added at the end of the article. The Reference list should be in the format as described previously.

Basic Science and Translational Research

Use the common format. Emphasis is on clinician comprehension. The **Abstract** uses the same common structured format. In the **Main text,** the **Introduction,** in addition to the usual context setting and rationale, should also contain explanations and descriptions of basic science concepts at the level of the educated layman. The **Methods** section should still be concise with sufficient detail for others to replicate the experiment, but one or two paragraphs in between explaining basic processes in plain English would be helpful. In the **Results** section, similar conciseness is still the rule, but a brief simplified summary of the findings should be provided. In the **Discussion,** clinical implications should be clearly stated. The **Conclusion,** again, should answer the research question.

Case Series and Case Reports

We encourage publication of case series or case reports if a comprehensive review of the literature is included, with the aim of helping the clinician manage rare and challenging diseases or conditions based on best available evidence in conjunction with practical, local experience. For the Thai Journal of Surgery, this implies that the case report format differs somewhat from that of the common format for research articles.

Abstract: Need not be structured. State objective of the case presentation, present a summary of the case, the outcome and learning points in one concise paragraph.

Main text: An **Introduction** is required to set the importance or relevance of the case within the current clinical context, based on a comprehensive literature review. A brief review of anatomy and pathology, or pathophysiology can be provided. **Report of the case** then follows with sufficient details on clinical presentation, diagnostic work up, interesting features, and decision making, to be useful for other surgeons. Surgical management should be concisely described and should be accompanied by high-resolution photographs or high-quality drawings and diagrams, if possible. Unique features of the case, and typical or general features should be distinguished. **Results** of management and follow-up information should be provided. **Discussion** then places the clinical, diagnostic, surgical and pathological features of the case within current knowledge or context and provides reasons for decision making and surgical management or otherwise. Wider implications of the case should be emphasized; for example, when management contradicts existing guidelines or when feasibility of some never-before performed surgery has been demonstrated. The **Conclusion** simply summarizes the case in terms of management implications.

Narrative Review Articles

Abstract: No structure is required. A description of the aims of the article and contents should be sufficient.

Main text: An **Introduction** serves to set the rationale or objective of the review. While systematic reviews focus on narrow research questions with aims of obtaining generalizable knowledge, the narrative review is education-based. The **main content** can be structured in anyway as is necessary for adequate comprehension. Finally, a **Conclusion** summarizes the content in greater detail than the abstract, emphasizing recent developments or future research.

Special Articles

Special articles are often solicited and may have no standard structure. But some structure will aid understanding or entice readers.

Abstract: A brief description of aims and content is sufficient.

Main text: An **Introduction** to set the aims of the article. The **main content** can be structured in any way. A **Conclusion** to summarize the content should be helpful, as well as to place some personal reflections.

Surgical Techniques

Abstract: A short description of what the techniques is about.

Main text: Description of the technique in sufficient detail such that a trained surgeon can perform the technique on his or her own. Good illustrations of the technique, step-by-step if possible, should be provided, in high-resolution photographs or well-executed drawings, or both.

Checking for Plagiarism and English Language Editing

The Thai Journal of Surgery policy on plagiarism and important notice for authors. The Thai Journal of Surgery takes the issue of plagiarism seriously. We have employed the services of the Akarawisut Plagiarism Detection (www.akarawisut.com) algorithm from Chulalongkorn University. All submitted manuscripts will undergo plagiarism checking prior to publication in the Journal. Authors must agree to this policy prior to submitting their manuscripts for publication. The results of plagiarism checking will be reported to all authors and coauthors as well as relevant authorities according to international guidelines.

Resources for English Language editing. The Thai Journal of Surgery suggests several vendors or individuals who will provide English Language Editing service for Authors of the Journal. These service providers are listed below. It is strongly recommended that Authors consider English editing by professional language editors if the manuscript has been marked as "English Editing Required" by the Journal. Recommended editing services and contact details can be obtained by emailing to rcst.tjs@gmail.com or Journal.TJS@gmail.com with a request for "English editing services".

Article Processing Charge (APCs)

There is no article processing charge. The Thai Journal of Surgery does not charge authors for submission, article processing, or publication fees.

The THAI Journal of SURGERY
Official Publication of The Royal College of Surgeons of Thailand

Vol. 45 July - September 2024 No. 3

The THAI Journal of SURGERY 2024;45(3):63.
Official Publication of The Royal College of Surgeons of Thailand

Editorial

Surasak Sangkhathat, MD, FRCST(Ped), PhD

Editor of The Thai Journal of Surgery

Thai Surgery Continues to Advance

Thai surgery remains at the forefront of medical innovation, continuously pushing the boundaries of patient care and surgical outcomes. This issue of the Thai Journal of Surgery reflects this dedication to progress with an array of original articles and case reports that showcase the latest advances in the field. We explore the effectiveness of a trauma fast-track protocol in Surat Thani Hospital and the external validation of the Trauma Injury Severity Score (TRISS) in patients with major injuries at a tertiary care public hospital. Furthermore, we delve into unique case reports, including pediatric living donor liver transplantation, a rare primary papillary mucinous carcinoma of the scalp, and the innovative use of a modified V-Y latissimus dorsi myocutaneous flap for extensive chest wall reconstruction. These contributions highlight the depth and breadth of surgical expertise in Thailand.

Recognizing Excellence in Surgical Research

A cornerstone of surgical advancement is continuously pursuing knowledge and innovation through research. We are proud to announce the winners of this year's The Royal College of Surgeons of Thailand awards, recognizing presentations of exceptional scientific value. This issue features 14 abstracts from the 'Resident Paper Award,' 9 from the 'Video Award,' 3 from the 'Thongueb Uttaravichien Award,' 3 from the 'ACS Basic Science Award,' and 6 from the 'Poster Award.' We commend these individuals for their dedication to advancing surgical science and improving patient outcomes. Their research serves as a testament to the commitment of the Thai surgical community to excellence in research and education.

The Thai Journal of Surgery: A Platform for Progress

As the official journal of The Royal College of Surgeons of Thailand, we are committed to providing a platform for disseminating cutting-edge research and clinical insights. This issue exemplifies our mission, showcasing the latest developments in Thai surgery and recognizing the achievements of those pushing the field's boundaries. We extend our gratitude to all contributors, reviewers, and editorial board members for their invaluable contributions. Together, we ensure that The Thai Journal of Surgery continues to serve as a beacon of surgical progress and innovation.

The THAI Journal of SURGERY

Official Publication of The Royal College of Surgeons of Thailand

Vol. 45 July - September 2024 No. 3

The THAI Journal of SURGERY 2024;45(3):64-69.
Official Publication of The Royal College of Surgeons of Thailand

Original Article

Effectiveness of Trauma Fast Track Protocol in Surat Thani Hospital

Thanakorn Orapan, MD,
Pariratana Phopluechai, MD

Department of Surgery, Surat Thani Hospital, Surat Thani, Thailand

Abstract

Background: The trauma audit showed that delayed operative surgery was the most important problem for the mortality rate in trauma patients. This study aims to compare timing from the emergency room (ER) to the operative room (OR) and the mortality rate of trauma patients with blunt or penetrated abdomen or active vascular injury with shock before and after trauma fast track (TFT) was established in Surat Thani Hospital.

Materials and Methods: Prospective comparative study with historical control aimed to analyze the ssociation between factors in fast-track trauma patients who visit the Emergency Department (ED) of our hospital between 1 September 2019 to 31 March 2022. We collected 190 trauma patients who met the criteria of TFT. The outcomes were analyzed, including comparing timing from ER to OR, mortality rate, and factors associated with mortality. Given a statistically significant difference of ***p***-value < 0.05.

Results: There were 87 patients in the pre-protocol group and 103 patients in the post-protocol group. The results showed average times from ER to OR time in the post-protocol group were less than the pre-protocol group (31 vs. 58-minute, ***p***-value < 0.001). The mortality cases of the pre- and post-protocol groups were 20 cases (24.10%) and 13 cases (12.15%); respectively, the ***p***-value was 0.031. However, we found that several factors correlated with mortality rate.

Conclusion: After implementing the TFT, injured patients underwent surgery earlier, and the mortality rate decreased. To improve survival, the assessment and referral system and quality of care should be improved and standardized.

Keywords: Trauma patients, Trauma Fast Track, ER to OR time

Received for publication 2 May 2024; Revised 14 August 2024; Accepted 16 August 2024

Corresponding author: Thanakorn Orapan, MD, Department of Surgery, Surat Thani Hospital, Surat Thani, Thailand; E-mail: sirelensar@gmail.com; Telephone: +66 63 914 495

Introduction

Injuries are defended as the result of road traffic crashes, falls, drowning, burns, poisoning, and acts of violence against oneself or others. More than 5 million people die each year as a result of injuries. This accounts for 9% of the world's deaths.[1] Injuries are also the leading cause of death for Americans aged 1 to 44 years and the third leading cause of death overall. Injury deaths have risen in the United States over the past 2 decades, from 52 per 100,000 in 2000 to 72 per 100,000 in 2016.[2] In Thailand, mortality rates by leading cause of death, road traffic accidents increased from 24.1 to 25.4 person per 100,000 population in 2017 and 2021 respectively.[3]

Abdominal trauma is also the leading cause of death in many trauma patients. Because the abdominal cavity contains vital organs such as the liver, spleen, kidneys, gastrointestinal tract, and vascular structure. When managing patients with general injuries, special attention should be given to abdominal injuries. The history taking and physical examination are the most important to diagnosing trauma patients, after the primary survey, adjunct to the primary survey, and secondary survey, considering the mechanism of the event in detail and the trajectory of the force acting on the body in blunt or penetrating injuries is the most significant to diagnosis and plan of investigation.

Schwartz's principles of surgery[4] indicated immediate surgical treatment in penetrating injured category, e.g., hemodynamic instability in gunshot wound or stab wound, peritonitis, and bowel evisceration. Moreover, in blunt abdominal mechanism categories such as FAST positive with hemodynamic instability and peritonitis, there should be no delay to operative management too. In patients with a positive FAST who required emergent laparotomy, delay in operation was associated with increased early and late in-hospital mortality. Delays in time to operation in trauma patients with a positive FAST should be minimized.[5]

The concept of a "Fast track," as defined by the Thai Ministry of Public Health,[6] refers to a healthcare service within the trauma system that aims to provide timely and critical care to patients within the "Golden hour" for definitive treatment (achieving the goal of 60 minutes from the door to the operating room). Each year, trauma audits have consistently shown that delayed surgical procedures are the most significant factor contributing to the mortality rate among trauma patients. To address this issue, a trauma fast track (TFT) has been implemented at Surat Thani Hospital to reduce the waiting time from the emergency room (ER) to the operating room (OR). This study aims to compare the timing from the ER to the OR and the mortality rate of trauma patients with blunt or penetrating abdominal injuries or active vascular injuries with shock who require immediate operative management before and after the establishment of the trauma fast track at Surat Thani Hospital.

Materials and Methods

This study utilized a prospective comparative design with a historical control group. It focused on fast-track trauma patients who presented to the ER of Surat Thani Hospital from September 2019 to August 2020 in the pre-protocol group and between September 2020 and March 2022 in the post-protocol group.

Study population, the inclusion criteria encompassed injured patients who visited the ER department of Surat Thani Hospital and had a mechanism of trauma involving blunt abdominal injury, penetrating abdominal injury, or active vascular injury with shock, the age range for inclusion was 15 to 90 years old, and immediate operative treatment from the ER to the operating room was required. Exclusion criteria consisted of patients who underwent cardiopulmonary resuscitation (CPR) either in the prehospital setting or in the ER, patients receiving conservative treatment, pregnant patients, and those undergoing operative treatment for other conditions such as neurological, orthopedic, or cardiovascular surgery.

Data were collected from 25,820 cases of minor and major trauma that visited the ER during the study period; the activated trauma fast-track protocol encompassed 739 injured cases, including those requiring endotracheal intubation, as well as cases of penetrating or blunt abdominal, chest, or neck injuries, and vascular injuries with shock.

Finally, we enrolled 190 patients who required immediate operative treatment and fulfilled the mechanism in our study: blunt abdominal injury with FAST positive and unstable hemodynamic or peritonitis, penetrating abdominal injury, and vascular injury that had emergency conditions to operative treatment. In pre-protocol, we found 83 and 107 patients in post-protocol, as shown in Figure 1.

This study was approved by the institutional ethics committee. Demographic data, such as gender, age, mechanism of injury, visit type, initial Glasgow Coma

Scale (GCS), initial systolic blood pressure (SBP), initial pulse rate (PR), initial hemoglobin (Hb) levels, Revised Trauma Score (RTS), comorbidity, operative time, OR waiting time, and mortality rate, hospital stay were collected. Multiple logistic regression defines independent factors for mortality rate. The significance of difference was estimated using chi-square for qualitative variables, significantly attaining $p \leq 0.05$ on univariate analysis or multivariate analysis considered clinically relevant in final statistical analysis using Stata® version 13.

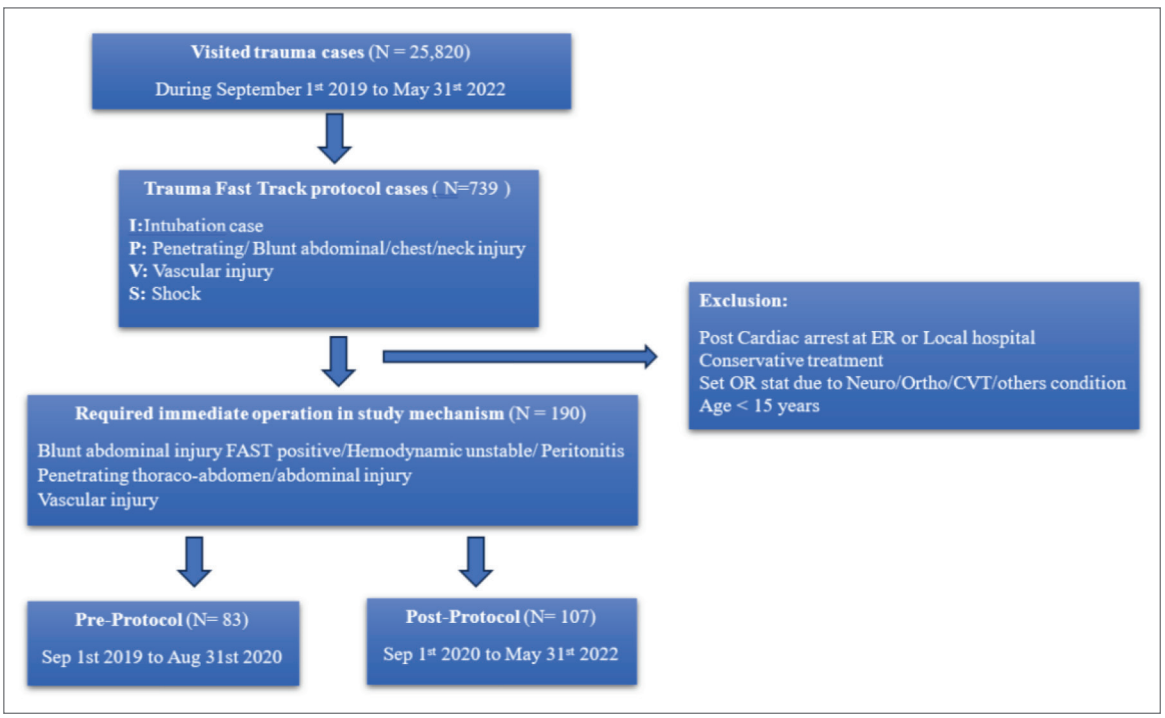

Figure 1

Results

Our study included 190 patients who underwent emergency operative treatment; 83 cases (45.79%) were in the pre-protocol group, while 107 cases (54.21%) were in the post-protocol group. The majority of the patients were males (79%) and aged under 60 (88%). Half of the patients were injured from blunt abdominal mechanisms (51.58%), a third from penetrating mechanisms (32.63%), and 15.79% from active vascular injuries. Most of the patients were transferred from the rural hospitals (82%). We found that three-quarters of the cohort had SBP ≥ 90 mmHg (73%), over half exhibited a pulse rate ≥ 100 beats per minute (55%), and initial hemoglobin levels were ≥ 10 mg/dl for 62%. In addition, we found 92% scored ≥ 4 in RTS. The majority, approximately 85% of the injured patients, had no comorbidities, and 65% took operative duration ≤ 60 minutes. However, the clinical epidemiological characteristics and laboratory data of this study are shown in Table 1.

Table 1 Demographic data

Demographic data	Number (Percent)		*p*-value
	Pre protocol (N = 83)	Post protocol (N = 107)	
Gender, n (%)			
Male	63 (75.90)	88 (82.24)	0.283
Age (years)			
< 60	72 (86.75)	97 (90.65)	0.394
Mechanism, n (%)			
Blunt abdominal	48 (57.83)	50 (46.73)	0.258
Penetrating	25 (30.12)	37 (34.58)	
Vascular injury	10 (12.05)	20 (18.69)	
Visit type, n (%)			
Referral	70 (84.34)	85 (79.44)	0.682
EMS	11 (13.25)	19 (17.76)	
Direct	2 (2.41)	3 (2.80)	
GCS (Glasgow Coma Score)			
< 8	18 (21.69)	11 (10.28)	0.095
8 - 12	9 (10.84)	13 (12.15)	
13 - 15	56 (67.47)	83 (77.57)	
SBP (mmHg)			
< 90	22 (26.51)	24 (22.43)	0.515
Pulse rate (bpm)			
< 100	33 (39.76)	51 (47.66)	0.277
Hemoglobin (mg/dl)			
< 10	38 (45.78)	33 (30.84)	0.035
Revised Trauma Score			
< 4	8 (9.64)	7 (6.54)	0.432
Comorbidity			
Yes	13 (15.66)	14 (13.08)	0.614
Operative duration time			
< 60 (min)	33 (39.76)	33 (30.84)	0.200

After implementing the trauma fast-track protocol, we found that the average time from the emergency room to the operating room was 32 minutes in the post-protocol group, while the average time was 59 minutes in the pre-protocol group. Furthermore, the two groups were significantly statistically different (p-value < 0.001) (Table 2). The mortality rates decreased in the post-protocol group, and survival rates also increased. In addition, there was a statistically significant difference between the two groups, as shown in Table 3.

Table 2 Primary outcome

Time to OR	Time to OR (min)		*p*-value
	Pre protocol (N = 83)	Post protocol (N = 107)	
Time average	58.73	31.83	< 0.001

Table 3 Secondary outcome – Mortality rate

	Number (Percent)		*p*-value
	Pre protocol (N = 83)	Post protocol (N = 107)	
Dead	16 (19.28)	13 (12.15)	0.031

Additionally, we identified factors independently associated with mortality rate through logistic regression analysis. Following univariate and multivariate analysis, we observed significant correlations between mortality rate and the following variables: GCS ≤ 8 (p = 0.02) and initial Hb < 10 mg/dl (p = 0.005), as shown in Table 4.

Table 4 Univariate and multivariate analysis of the factors that correlated with the mortality rate

Variables	Univariate Analysis			Multivariate Analysis		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Age ≥ 60 yrs.	0.67	0.27 - 1.63	0.39	0.70	0.28 - 1.73	0.43
GCS ≤ 8	0.40	0.18 - 0.89	0.01	0.41	0.19 - 0.92	0.02
SBP < 90 mmHg	0.76	0.39 - 1.49	0.42	0.77	0.39 - 1.50	0.44
Pulse ≥ 100 bpm	0.73	0.41 - 1.31	0.29	0.71	0.40 - 1.27	0.24
Hb < 10	0.41	0.22 - 0.77	0.003	0.43	0.23 - 0.78	0.005
Co-morbidity; present	0.81	0.36 - 1.84	0.61	0.86	0.38 - 1.97	0.73
Operative time ≥ 60 min	1.48	0.80 - 2.71	0.20	1.44	0.79 - 2.63	0.23

Discussion

This kind of TFT research has been conducted in multi-hospitals that establish the protocol, such as in the USA,[7] Khon Kaen Hospital,[8,9] Prachinburi Hospital,[10] and Buddhachinaraj Hospital[11] Phitsanulok. Our research focuses on general surgery mechanisms such as blunt, penetrating abdomen, and vascular injury that require emergency operative treatment, excluding neurosurgery, orthopedics, and cardiothoracic conditions.

Our study in demographic data showed mechanism mostly half of the patients were injured from blunt abdominal mechanism (51.58%), while T Impool[8,9] (Khon Kaen Hospital) mostly mechanism is from penetrating injury with shock (74.29%), our study in Revised Trauma Score (RTS) shown no difference between pre and post protocol group while Kraysubun C[10] (Prachinburi Hospital) shown more severity in post protocol group. However, there were no significant differences between

pre- and post-protocol groups in terms of gender, age, mechanism, type of visit, GSS, initial SBP, initial pulse rate, RTS, Comorbidity, or Operative time. Meanwhile, initial hemoglobin levels were shown to be ≥ 10, mostly in the post-protocol group (62%).

The aim of this study was to examine the impact of implementing a trauma care system outcome, specifically focusing on the mortality rate and the ER to OR time. The findings of this study revealed a decrease in both mortality rates among injured individuals and waiting time. These results, similar to previous research reports such as in Khon Kaen Hospital,[8,9] Prachinburi Hospital,[10] and Buddhachinaraj Hospital,[11] revealed that patients who underwent surgery experienced reduced waiting times, leading to a decrease in the mortality rate.

Recently, studies reported[12-15] that decreased GSC, and high Injury Severity Score (ISS) scores were associated with mortality rates. similar to this study that reported GCS < 8 and initial hemoglobin < 10 mg/dl correlated with mortality risk based on univariate and multivariate analysis. Both factors were statistically different between the pre- and post-protocol groups, which supports that the TFT protocol had an effect on the mortality rate.

Based on these findings, it is advisable to minimize unnecessary procedures or interventions at the ER. Ensuring adequate fluid resuscitation and the availability of blood components were crucial aspects of the resuscitation process. Implementing the protocol at local hospitals enables the proper activation of TFT and facilitates effective resuscitation. It is important to practice routinely and review the protocol within the local hospital, emergency department, trauma team, and multidisciplinary team. Regular case discussions and feedback sessions are essential for continuous learning and improving patient outcomes.

Conclusion

Following the implementation of the TFT protocol, there was a significant reduction in the ER-to-OR time for patients requiring immediate operation, and the mortality rates also showed a significant decrease. Among the factors contributing to mortality cases, having GCS ≤ 8 and initial hemoglobin < 10 mg/dl were found to be significant.

References

1. Department for the Management of Noncommunicable Diseases, Disability, Violence and Injury Prevention, World Health Organization (WHO). Injuries and Violence: The Facts 2014; 2014. [cited 2021 Dec 20]. Available from: https://iris.who.int/bitstream/handle/10665/149798/9789241508018_eng.pdf.
2. Feliciano DV, Mattox KL, Moore EE. eds. Trauma. 9th ed. New York: McGraw Hill, 2020.
3. Health Information Office, Strategy and Planning Division, Office of the Permanent Secretary Ministry of Public Health (Thailand). Public Health Statistics A.D. 2021 (in Thai). Nonthaburi: Strategy and Planning Division, Ministry of Public Health (Thailand), 2022.
4. Brunicardi F, Andersen DK, Billiar TR, et al. eds. Schwartz's Principles of Surgery. 11th ed. New York: McGraw Hill. 2019.
5. Barbosa RR, Rowell SE, Fox EE, et al. Increasing time to operation is associated with decreased survival in patients with a positive FAST examination requiring emergent laparotomy. J Trauma Acute Care Surg. 2013;75(1 Suppl 1):S48-52. doi: 10.1097/TA.0b013e31828fa54e.
6. Division of Medical Technical and Academic Affairs, Department of Medical Services, Ministry of Public Health (Thailand). Guideline for ER service delivery (in Thai). Bangkok: Samchai 2017. 2018.
7. Harvin JA, Maxim T, Inaba K, et al. Mortality after emergent trauma laparotomy: A multicenter, retrospective study. J Trauma Acute Care Surg. 2017;83(3):464-8. doi: 10.1097/TA.0000000000001619.
8. Impool T. Effectiveness of trauma fast track in Hhon Kaen regional hospital. Injury Prevention 2012;18(Suppl 1):A91. doi: 10.1136/injuryprev-2012-040590b.8.
9. Impool T, Reungjui P, Tansura S. 596 The association between duration to operation and mortality rate in penetrating trauma patients. Injury Prevention. 2016;22(Suppl 2):A214. doi: 10.1136/injuryprev-2016-042156.596.
10. Klaysubun C. Effect of development of trauma system on outcome of major trauma patients in Prachinburi Province. BJM. 2018;5(1):29-35.
11. Supap A. Survival factors of trauma patients in trauma fast track. Buddhachinaraj Med J 2019;36(3):355-62.
12. Wongvatanakij P, Tadadej C, Meyai A, et al. Relation of Factor on Survival Outcomes among Traumatic Patients at the Tertiary care Hospital Admitted for Traffic Accidents in Phuket Province. Srinagarind Med J. 2019;34(1):52-9.
13. Jongaramrueng N, Tangsiricharoen S. Factors Associated with the Mortality Rate in Trauma Patients in the Luntom EMS Center, Queen Savang Vadhana Memorial Hospital (in Thai). JPMC. 2022;39(1):53-62.
14. Chiang YT, Lin TH, Hu RH, et al. Predicting factors for major trauma patient mortality analyzed from trauma registry system. Asian J Surg. 2021;44(1):262-8. doi: 10.1016/j.asjsur.2020.06.014.
15. Pintatham K, Plongniras W. Factors Associated with 24 Hours Mortality of Traumatic Patients in Chiang Rai Province, Thailand. J Emerg Med. 2022;2(1):66-76.

The THAI Journal of SURGERY 2024;45(3):70-75.
Official Publication of The Royal College of Surgeons of Thailand

Original Article

External Validation of the Trauma Injury Severity Score (TRISS) in Patients with Major Injuries at a Tertiary Care Public Hospital in Thailand

Ploytip Jansiriyotin, MD

Department of Surgery, Khon Kaen Hospital, Khon Kaen, Thailand

Abstract

Objective: To externally validate TRISS's probability of survival in a tertiary care hospital in northeastern Thailand.

Materials and Methods: A retrospective cohort prognostic study included patients with significant injuries (ISS > 15) admitted to the hospital from 2011 to 2022 from the Khon Kaen trauma registry. Baseline characteristics were identified. AuROC presented the accuracy of the model. The age group was used as a subgroup analysis. The primary outcome was in-hospital mortality.

Results: This retrospective cohort study was conducted at a tertiary care public hospital in northeastern Thailand. A total of 20,867 patients were included. Missing primary outcome data were excluded. Most patients were male (75.23%). The mean age was 38.19 ± 19.65 years. The mean ISS was 20.17 ± 5.28. The mortality rate was 15.33%. AuROC was 0.8388. Subgroup analysis by age group showed a statistically significant reduction in AuROC by increasing age.

Conclusion: The accuracy of the TRISS model in a tertiary care hospital in Thailand was excellent, as close as MTOS. The accuracy was decreased by age. The TRISS model is applied to trauma quality improvement programs in Thailand.

Keywords: TRISS, Major trauma, External validation, Prediction model

Introduction

Unintentional injuries were the leading cause of death worldwide, especially in young adults.[1] It caused a significant loss in gross domestic product (GDP) and workforce that drove the country. There have been attempts to reduce such mortality and morbidity from the injuries. Benchmarking, by comparing preventable death rates within and among the hospitals, served as one tool among many in the trauma quality improvement program.[2] Reduction in deaths may reflect better prevention and management policies. A trauma registry collecting data on the probability of survival (PS) was used for the criteria. Deaths among patients with a PS greater than 0.5 were considered preventable,[2] including Thailand. The next step would be a Morbidity and mortality (M&M) conference, where the committee would analyze what occurred and devise strategies to prevent such deaths from happening again.

One of the most widely used PS models in trauma patients was the trauma injury severity score (TRISS), developed from a Major Trauma Outcome Study (MTOS) in the United States.[3,4] It combines anatomic, physiologic, and comorbidity survival criteria. Injury severity score (ISS), revised trauma score (RTS), age, and the mechanism of injury were used to develop the model using logistic regression. Although there were some

Received for publication 2 April 2024; Revised 16 May 2024; Accepted 2 September 2024

Corresponding author: Ploytip Jansiriyotin, MD, Department of Surgery, Khon Kaen Hospital, 54 Srichant Rd., Tambon Nai Muang, Amphoe Muang, Khon Kaen 40000; Telephone: +66 93 626 1541; E-mail: ploytip.jansiriyotin@gmail.com

modifications and validations of the model in low-to-middle-income countries,[5-11] the standard for comparative evaluation remained the original model. There has been no external validation of the TRISS model in Thailand, which has one of the highest rates of road traffic injuries (RTIs),[12] and differs significantly in injury epidemiology from the data used to develop the original model; this divergence might affect the model's accuracy.

The objective of this study is to externally validate the TRISS model in Khon Kaen Hospital, a tertiary care hospital and referring trauma center in northeastern Thailand.

Materials and Methods

Study design and collection

A retrospective, prognostic cohort study was conducted using the trauma registry of a trauma center in our hospital. The institutional ethics committee approved the proposal. The data were collected by an online trauma center injury surveillance (IS) officer from 1st January 2011 to 31st December 2022. All patients admitted during this period, whether to the trauma ward or other departments, were included in this study. Due to the comprehensive inclusion, the study size was not calculated. A trauma center IS online officer conducted data entry in real time to reduce recall bias.

Participants

The eligibility criteria include all the patients with significant trauma defined by ISS as more important than 15,[13] admitted to our hospital. The exclusion criterion was patients declared dead before arrival. The follow-up period extended up to discharge status, either survived or dead.

Variables and outcomes

The predictors in this study were the parameters in the TRISS probability of survival (PS) model: age, mechanism of injury, injury severity score (ISS), revised trauma score (RTS), and Glasgow coma scale (GCS) score. Sex was also included as a predictor.

No potential confounders or effect modifiers were identified, as each predictor served as a prognostic factor. The trauma center IS officer would assign the Abbreviated Injury Scale (AIS) for each injury and automatically calculate the ISS. The 1998 version of the AIS was used for AIS coding in all patients. RTS was derived from systolic blood pressure (SBP), respiratory rate (RR), and GCS score collected from the trauma registry and automatically calculated. The primary outcome was in-hospital mortality.

TRISS calculation model

The TRISS model was first developed and used in North America to predict mortality and has been accepted as one of the best models for estimating trauma survival. It is a combined scoring system consisting of ISS as the anatomical criterion, RTS as the physiological criterion, and age as the comorbidity criterion. The scores are calculated using coefficients derived from logistic regression, which are separated by the mechanism of injury.[3]

The ISS ranges from 0 to 75 and is calculated from the AIS score. Age is categorized into 0 and 1, with patients aged 18 to 54 categorized as 0 and those aged 55 and over as 1. The RTS is determined by three parameters: SBP, RR, and GCS score. These parameters are combined into a coefficient as follows:

For blunt mechanism trauma,

b = (- 0.4499) + (0.8085) (RTS) + (- 0.0835) (ISS) + (- 1.7430) (Age)

For penetrating mechanism trauma,

b = (- 2.5355) + (0.9934) (RTS) + (- 0.0651) (ISS) + (- 1.1360) (Age)

For PS calculation, the equation is PS = 1/ (1- e^b)

PS values range from 0 to 1.

Statistical analysis

Categorical data were described using frequency and percentage and tested using Fisher's exact probability test. Normally distributed continuous data were described using means and standard deviations and were tested using independent t-tests. Non-normally distributed continuous data were described using the medians and interquartile ranges. Statistical uncertainties were expressed as 95% two-sided confidence intervals in all analyses. A p-value less than 0.05 was considered statistically significant. No multivariable adjustment was used in the analyses. The primary outcome others were shown as missing data, presented as counts (n) and percentages (%). All statistical analyses were performed with STATA version 16 (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC). The area under the receiver operating characteristic (AuROC) curve was plotted between survival and PS.

Results

The data were collected from January 2011 to December 2022 from all significant trauma victims admitted to the hospital. None of the patients were excluded. A total of 20,867 patients were included. The missing primary outcome data numbered 2,362 (11.32%). Most patients were male (75.23%). The mean age was 38.19 ± 19.65 years. The main mechanism of injury was blunt (92.96%). The in-hospital mortality was 15.33%. Physiologic characteristics are shown in Table 1. All of the results from Table 1 were statistically significant between survivors and those deceased.

Table 1 Baseline characteristics of major trauma patients

Baseline characteristics	Missing data, n (%)	all, n = 20,867	Survivors, n = 15,669 (84.67%)	Dead, n = 2,836 (15.33%)	*p*-value
Male, n (%)	1,640 (7.86)	12,954 (75.23)	10,798 (74.25)	2,156 (80.54)	0.000
Age, years (mean ± SD)	8 (0.04)	38.19 ± 19.65	37.15 ± 19.47	43.93 ± 19.69	0.000
Mechanism: blunt (%)	2,795 (13.39)	16,799 (92.96)	12,449 (92.72)	2,609 (97.35)	0.000
SBP at ER, mmHg (mean ± SD)	132 (0.63)	126.34 ± 35.88	127.72 ± 31.96	118.68 ± 51.89	0.000
RR at ER, bpm [median, IQR]	54 (0.26)	20 [0, 20] 2	20 [0, 20]	0 [0, 18]	0.000
eGCS at ER [median, IQR]	82 (0.39)	4 [1, 4]	4 [3, 4]	1 [1, 3]	0.000
vGCS at ER [median, IQR]	70 (0.34)	5 [1, 5]	5 [1, 5]	1 [1, 1]	0.000
mGCS at ER [median, IQR]	97 (0.46)	6 [5, 6]	6 [5, 6]	4 [1, 5]	0.000
GCS at ER [median, IQR]	100 (0.48)	15 [7, 15]	15 [10, 15]	6 [3, 9]	0.000
ISS (mean ± SD)	5,905 (28.30)	20.17 ± 5.28	19.43 ± 4.39	23.63 ± 4.35	0.000
RTS (mean ± SD)	183 (0.88)	6.48 ± 1.83	6.85 ± 1.51	4.41 ± 2.08	0.000
TRISS - PS (mean ± SD)	5,998 (28.74)	0.84 ± 0.24	0.90 ± 0.18	0.58 ± 0.31	0.000

SD = standard deviation; SBP = systolic blood pressure; ER = emergency room; RR = respiratory rate; bpm = beat per minute; IQR = interquartile range; eGCS = eye response in Glasgow coma scale; vGCS = verbal response in Glasgow coma scale; mGCS = motor response in Glasgow coma scale; ISS = injury severity score; RTS = revised trauma score; TRISS – PS = trauma injury severity score probability of survival

The AuROC curve tested the accuracy of the TRISS in major trauma patients. The area under the curve was 0.8400. Figure 1 shows the AuROC curve of the TRISS model.

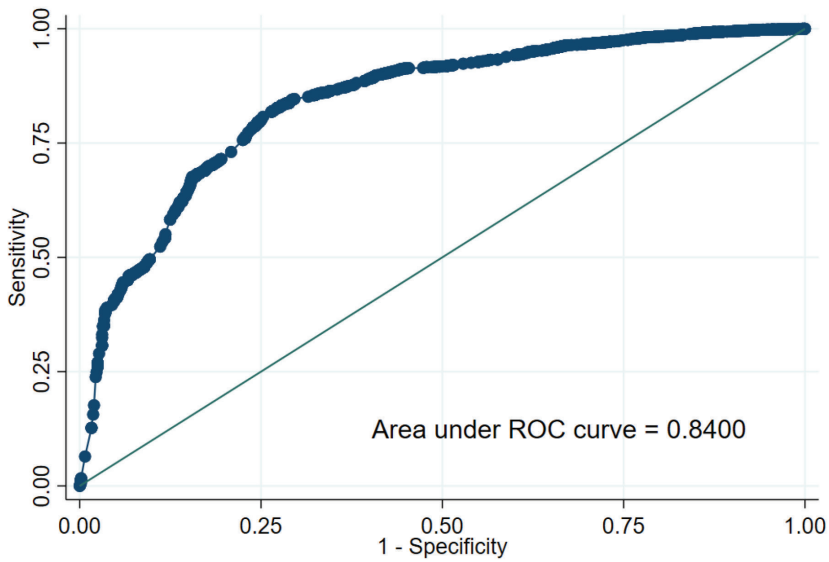

Figure 1 Area under receiver operating characteristic (AuROC) curve

In a subgroup analysis by age presented in Table 2, there was a decrease in AuROC as age increased. The difference between age groups was statistically significant (p-value < 0.001)

Table 2 Subgroup analysis by age

Age group (years)	Observation	AuROC	95% CI
0 - 20	2,881	0.8999	0.88260, 0.91715
21 - 40	4,663	0.8626	0.84713, 0.87803
41 - 60	4,623	0.8126	0.79678, 0.82840
61 - 80	2,315	0.7843	0.76122, 0.80742
> 80	294	0.8109	0.75597, 0.86585

AuROC = area under receiver operating characteristic; CI = confidence interval

In comparing AuROC curves among TRISS, RTS, and ISS, the TRISS model showed the best performance, which was statistically significant (Table 3).

Table 3 Comparison of TRISS, RTS, ISS

Models	Observation	AuROC	95% CI	
TRISS	14,780	0.84	0.83156	0.84854
RTS	14,780	0.804	0.79408	0.81382
ISS	14,914	0.6609	0.64790	0.67383

p-value < 0.001

AuROC = area under receiver operating characteristic; CI = confidence interval; TRISS = trauma injury severity score; RTS = revised trauma score; ISS = injury severity score

Discussion

There were more than 50 prediction models for trauma patients.[14] TRISS was among the most popular due to the nature of the combination scoring system and its accuracy. Through several external validations in various countries and settings, including low-to-middle-income countries and RTIs,[11,15-17] most used a small sample size. The TRISS model also had limitations,[18] such as the inability to account for multiple severe injuries in a single body part, an inability to predict a low mechanism of injury, and a lack of accuracy in interhospital comparisons.

RTIs were the leading cause of death among trauma patients in Thailand, an upper-middle-income country,[19] ranking 20th countries with RTI deaths. This injury epi-

demiology differed from the MTOS study, which raised questions about the applicability of the TRISS model in the country.

The accuracy of the TRISS model in this study was consistent with the MTOS and Malaysian National Trauma Data Bank (NTrD) studies.[10] The AuROC curve of the TRISS from Khon Kaen Hospital's trauma registry showed excellent prediction, implying generalizability in countries with various road infrastructures, traffic laws, and RTI prevention policies.

On the other hand, subgroup analysis by age group showed a decline in the AuROC curve with increasing age groups. The applicability in the elderly population may be questionable, highlighting the limitation of the TRISS model as comorbidity scores were only binary and too rough to distinguish the difference.

The TRISS model also exhibited the best performance among other scoring systems. According to the TRISS scoring system, which was the combined model, this is straightforward; RTS is a physiologic score, and ISS is an anatomical score.

This study is a pioneer in external validation of the TRISS model in a tertiary care public hospital in Thailand, a level 1 trauma center, and a referral center with a provincial trauma registry. This databank is well-known for its completeness, large scale, and systematic data collection, increasing the generalizability of the results due to various parameters.

There are several limitations to this study. Firstly, it was a retrospective study with inherent information bias. Choosing the study design, including appropriate data-collecting protocols, was a primary strategy to reduce this bias. Additionally, the main data collector was not involved in the analytical component. Secondly, a high number of missing survival outcomes led to selection bias. Missing values were declared to aid decision-making. The author did not include patients with arrest-on-arrival status in the study because this group was not admitted to the hospital, leading to another selection bias. Lastly, this was a single-center study with a high mortality rate at a tertiary care referral center. The applicability to other levels of trauma centers, including community hospital benchmarking, remains unknown.

Conclusion

TRISS model exhibits excellent performance among primary trauma victims treated by a tertiary care trauma center in northeastern Thailand. Although it is the best model for predicting the probability of survival, its performance declines with the patient's age increases.

Conflicts of Interest

There is nothing to declare.

Acknowledgment

The author would like to thank the Trauma and Critical Care Center officers, especially Dr. Tawatchai Impool, Dr. Witaya Chadbunchachai, and Ms. Natthira Daengruan, for their tremendous support in obtaining the raw data from the Khon Kaen trauma registry. Also, the trauma team colleagues and the department of surgery, Khon Kaen Hospital, for their approval to conduct this study. In addition, special thanks to Dr. Suppachai Lawanaskol for his methodology and clinical statistics support.

REFERENCES

1. FastStats. Leading Causes of Death; 2024 [cited 2024 March 24]. Available from: https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm
2. American College of Surgeons. Trauma Quality Improvement Program (TQIP); 1996-2024. [cited 2024 March 24]. Available from: https://www.facs.org/quality-programs/trauma/quality/trauma-quality-improvement-program/
3. Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma. 1987;27(4):370-8.
4. Champion HR, Copes WS, Sacco WJ, et al. The Major Trauma Outcome Study: establishing national norms for trauma care. J Trauma. 1990;30(11):1356-65.
5. Hadisaputra IH, Suwedagatha G, Mahadewa TG. Adjustment of Trauma and Injury Severity Sccore (TRISS) and Revised Trauma Score (RTS) in Predicting Mortality of Multitraumapatients in Sanglah Hospital Bali. Biomed Pharmacol J. 2021;14(1):267-72. doi: 10.13005/bpj/2122.
6. Hariharan S, Chen D, Parker K, et al. Evaluation of trauma care applying TRISS methodology in a Caribbean developing country. J Emerg Med. 2009;37(1):85-90. doi: 10.1016/j.jemermed.2007.09.051.
7. Driessen MLS, van Klaveren D, de Jongh MAC, et al. Modification of the TRISS: simple and practical mortality prediction after trauma in an all-inclusive registry. Eur J Trauma Emerg Surg. 2022;48(5):3949-59. doi: 10.1007/s00068-022-01913-2.
8. Domingues CA, Coimbra R, Poggetti RS, et al. Performance of new adjustments to the TRISS equation model in developed and developing countries. World J Emerg Surg. 2017;12:17. doi: 10.1186/s13017-017-0129-2.

9. Roy N, Gerdin M, Schneider E, et al. Validation of international trauma scoring systems in urban trauma centres in India. Injury. 2016;47(11):2459-64. doi: 10.1016/j.injury.2016.09.027.
10. Tan JH, Tan HCL, Noh NAM, et al. Validation of the trauma mortality prediction scores from a Malaysian population. Burns Trauma. 2017;5:37. doi: 10.1186/s41038-017-0102-z.
11. Kaza VK, Nathan B. Validity of Trauma and Injury Severity Score Scoring in India. J Emerg Trauma Shock. 2023;16(1):30-31. doi: 10.4103/jets.jets_120_22.
12. World Health Organization. Global status report on road safety 2023; 2023. [cited 2024 March 24]. Available from: https://www.who.int/publications-detail-redirect/9789240086517.
13. Van Ditshuizen JC, Sewalt CA, Palmer CS, et al. The definition of major trauma using different revisions of the abbreviated injury scale. Scand J Trauma Resusc Emerg Med. 2021;29(1):71. doi: 10.1186/s13049-021-00873-7.
14. Feliciano DV, Mattox KL, Moore EE. Trauma, Ninth Edition. 9th Edition. New York: McGraw Hill / Medical, 2020:1440.
15. Podang J, Singhasivanon P, Podhipak A, et al. Primary verification: is the TRISS appropriate for Thailand? Southeast Asian J Trop Med Public Health. 2004;35(1):188-94.
16. Scarpelini S, de Andrade JI, Dinis Costa Passos A. The TRISS method applied to the victims of traffic accidents attended at a tertiary level emergency hospital in a developing country. Injury. 2006;37(1):72-7. doi: 10.1016/j.injury.2005.06.006.
17. Siritongtaworn P, Opasanon S. The use of Trauma Score-Injury Severity Score (TRISS) at Siriraj Hospital: how accurate is it? J Med Assoc Thai. 2009;92(8):1016-21.
18. Cayten CG, Stahl WM, Murphy JG, et al. Limitations of the TRISS method for interhospital comparisons: a multihospital study. J Trauma. 1991;31(4):471-81. doi: 10.1097/00005373-199104000-00005.
19. The World Bank. Overview The World Bank in Thailand. [cited 2024 March 24]. Available from: https://www.worldbank.org/en/country/thailand/overview.

The THAI Journal of SURGERY 2024;45(3):76-82.
Official Publication of The Royal College of Surgeons of Thailand

Case Report

Pediatric Living Donor Liver Transplantation from Adult Allograft Liver After Resection of Focal Nodular Hyperplasia: The Report Three Cases

Nattapat Khemworapong, MD[1]
Nuttapon Arpornsujaritkun, MD[1]
Pattana Sornmayura, MD[2]
Chollasak Thirapattaraphan, MD[3]
Ampaipan Boonthai, MD[3]
Surasak Leelaudomlipi, MD[1]
Bundit Sakulchairungrueng, MD[1]
Goragoch Gesprasert, MD[1]
Veeravorn Ariyakachorn, MD[1,4]
Suthus Sriphojanart, MD[1]
Pattawia Choikrua[5]

[1] *Vascular and Transplantation Unit, Department of Surgery, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*
[2] *Department of Pathology, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*
[3] *Pediatric Surgery Unit, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*
[4] *Bumrungrad International Hospital, Bangkok, Thailand*
[5] *Surgical Research Unit, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*

Abstract Three pediatric living donor liver transplants were performed at Ramathibodi Hospital in Thailand. The recipients were two children with biliary atresia and one child with neonatal cholestasis jaundice with suspected biliary atresia. All three donors had a single liver lesion, which was suspected to be focal nodular hyperplasia (FNH) on preoperative imaging.

Because no other living donor candidates were available for the recipients, living donor liver transplants were performed. First, a wedge resection of the liver mass was performed. The liver mass was sent for a frozen section intraoperatively to confirm the diagnosis of a benign lesion and to ensure free-margin resection. Then, the transplantation was performed using a standard technique. The liver masses were 1.4-2.3 cm in diameter.

The liver donor hepatectomy was performed simultaneously with the recipient's total hepatectomy. The estimated liver graft volume was 176.5-336.5 cm3. The estimated graft-recipient weight ratio (GRWR) was 1.4-3.7%. The actual graft weight was 168-371 grams, and the actual GRWR was 1.6-3.5%. The liver graft was implanted in the recipient using a standard piggyback technique.

The donor and recipient were discharged after the operation without any complications. Follow-up ultrasound of the upper abdomen at six months showed no disease recurrence.

Keywords: Living liver donor, Pediatric liver transplantation, Focal nodular hyperplasia

Received for publication 3 May 2024; Revised 16 August 2024; Accepted 16 August 2024

Corresponding author: Nuttapon Arpornsujaritkun, MD, Vascular and Transplant Unit, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, 270 Rama 6 road, Rajathevee, Bangkok 10400; E-mail: arpornsujaritkunn@gmail.com; Telephone: +662 201 1304, Fax: +662 201 1304

Introduction

Most Asian countries perform liver transplants from living donors because of the low rate of deceased donor donation. Especially, a pediatric liver transplant has a low chance of getting a liver from a deceased donor because the splitting of the liver to a pediatric patient needs a high-quality liver from a deceased donor.[1,2] Focal nodular hyperplasia (FNH) is the second most common benign liver tumor. The usual incidental finding is from investigations in mostly premenopausal women and asymptomatic.[3] A liver allograft with mass is a marginal organ for liver transplantation, but FNH is a benign liver tumor without the potential for malignant transformation. The treatment of choice for FNH is expectant management and follow-up of the imaging. So, it probably expanded the organ donation pool.

There are 3 previous reports of the successful outcome of liver transplantation from liver allograft with FNH. The follow-up showed no clinical difference.[4-6]

The success of living donor liver transplantation (LDLT) is donor safety with adequate functional liver for the recipient. There are few published reports about liver allografts with FNH. One report using deceased donor liver allograft with FNH.[4] Two reports using living donor liver allograft with FNH from adult-to-adult LDLT.[5,6] We report on adult to pediatric LDLT from liver allograft with FNH.

Presentation of Cases

Case 1

A Thai boy, 2 years and five months old, presented with recurrent cholangitis. His comorbid disease was biliary atresia with post-operative portoenterostomy (Kasai's operation), cirrhosis, portal hypertension, and hepatorenal syndrome. After Kasai's operation was performed, he was admitted to several episodes due to recurrent cholangitis or upper gastroesophageal bleeding (UGIH). Physical examination findings: body weight 13.5 kilograms, marked ascites, no melena. Laboratory findings: hematocrit 14%, platelet 55,000 per microliter, prothrombin time international normalized ratio 2.39, total bilirubin 3.8 mg/dl, albumin 1.83 g/dl, serum creatinine 0.55 mg/dl. Our workup found cirrhosis from liver biopsy and esophageal varices from Esophagogastroduodenoscopy (EGD). Pediatric end-stage liver disease (PELD) score of 24.3 points. He was admitted for nutritional improvement and treatment of recurrent cholangitis. Reevaluation PELD score of 19.8 points before liver transplantation. This recipient has an indication for liver transplant by the failure of Kasai's operation with recurrent cholangitis.

The living liver donor was his mother, a 32-year-old woman. She has the thalassemia trait but no other underlying disease. Physical examination was unremarkable. Her laboratory was within normal limits. Computed tomography (CT) scan and magnetic resonance imaging (MRI) showed a solid mass of 1.5 cm at segment III, which is suspected to be focal nodular hyperplasia (FNH) by correlation with her history and imaging characteristics (Figure 1a, 1b). The estimated left lateral liver volume was 230.49 cm3, and the estimated graft-recipient weight ratio (GRWR) was 1.7% – no contraindication by liver anatomy.

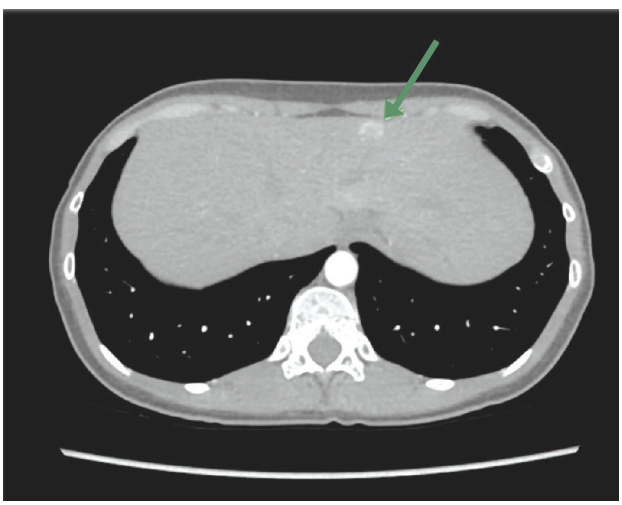

Figure 1a Contrast CT scan shows the mass size 1.5 cm. at segment 3 (S3) in the arterial phase.

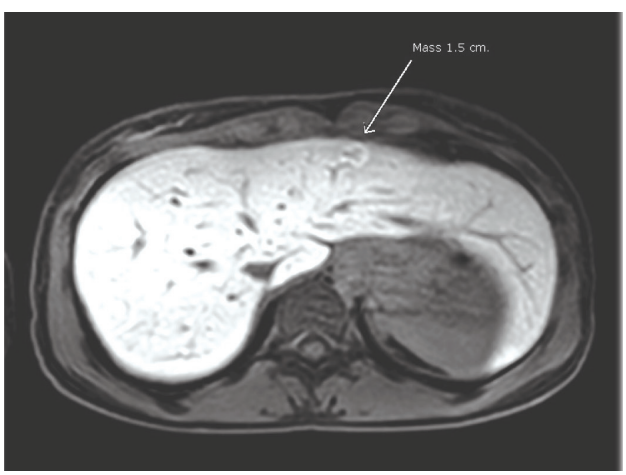

Figure 1b MRI scan shows the mass size 1.5 cm. at segment 3.

The recipient and donor operations were performed as standard procedures. The donor procedure was performed first to evaluate liver mass and intraabdominal organs. The wedge resection of the liver mass at segment III was performed using an intraoperative ultrasound guide and a cavitron ultrasonic surgical aspirator (CUSA) without the Pringle maneuver (Figure 1c). The specimen was sent for pathologic examination intraoperatively. After the pathologist was reported to confirm FNH with a free margin of 4 mm., the operation of the recipient was started for an explant liver, and then the donor's left lateral hepatectomy was proceeded at the same time. The donor's total operative time was 450 mins, and total blood loss was 600 ml. The actual left lateral segment weight was 250 grams, and the actual GRWR was 1.8%.

Implant liver grafting was performed with the standard procedure – no massive bleeding at the cutting surface and wedge resection area after reperfusion. The total recipient operation was 760 minutes, and total blood loss was 7,250 ml. due to severe adhesion from the previous recipient's procedure.

The donor's ultrasound of the upper abdomen at seven months after surgery showed no recurrence of the FNH.

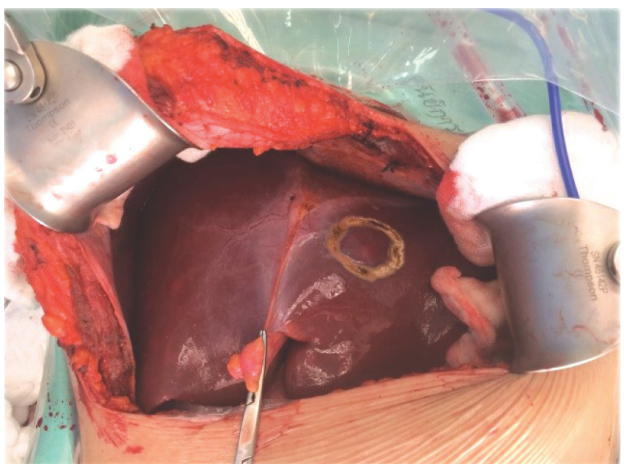

Figure 1c Intraoperative picture showed liver mass size 1.5 cm. segment 3 was marked by electrocautery.

Case 2

A 1-year-old Thai female with an unknown case of cholestasis jaundice with a differential diagnosis of Neonatal intrahepatic cholestasis caused by citrin deficiency. Her presenting symptom was neonatal jaundice without a pale stool; the intraoperative cholangiogram showed that contrast could pass from the hepatic duct to the duodenum. Then she was turned to decompensated cirrhosis with PELD 19 and was needed for liver transplantation. Her weight was 8.95 kg.

The living donor was her mother, a 33-year-old Thai female without any underlying disease. Physical examination was unremarkable; her laboratory test was within normal limits. Computed tomography (CT) scan and magnetic resonance imaging (MRI) showed a solid enhancing mass of about 2.3 cm with a central scar at segment VII, which was suspected of focal nodular hyperplasia (FNH) from correlation with the imaging characteristic (Figure 2a, 2b) Estimated left lateral segment was 336.5 cm^3. The estimated GWRWR was 3.7%.

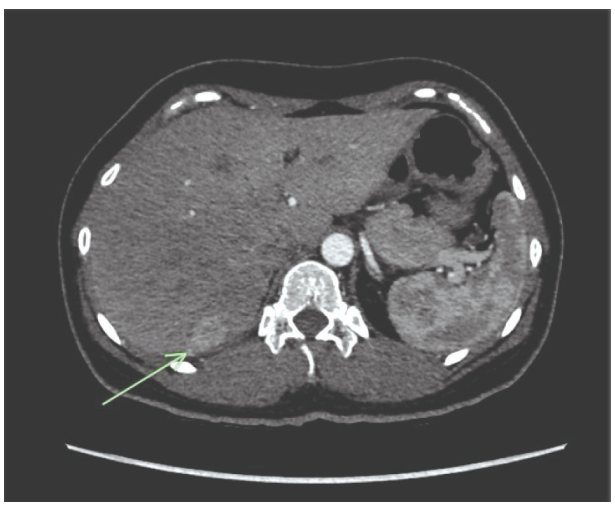

Figure 2a Contrast CT scan shows the mass size of 2.3 cm at segment VII in the arterial phase.

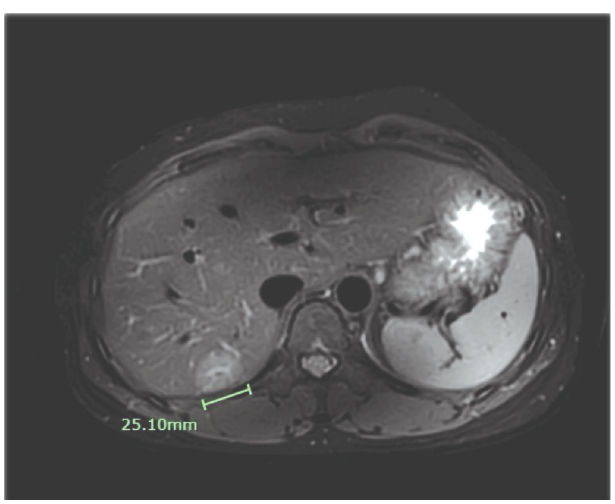

Figure 2b MRI scan shows the mass size of 2.5 cm at segment VII.

The recipient and donor operations were performed as standard procedures. The donor procedure was performed first to evaluate liver mass and intraabdominal organs. The liver mass wedge resection was performed, and segment VII using intraoperative ultrasound guide and electrocautery without Pringle maneuver. The specimen was sent for pathologic examination intraoperatively. After the pathological report was confirmed, FNH with free margin. The explanation of the recipient's liver was started simultaneously with the donor's left lateral segmentectomy. The donor's total operative time was 270 mins, and total blood loss was 250 ml. Actual left lateral segment weight was 317 grams, and actual GRWR was 3.5%.

Implant liver grafting was performed with the standard procedure – no massive bleeding at the cutting surface and wedge resection area after reperfusion. Total recipient operation was 580 minutes, and total blood loss was 800 ml.

Case 3

A 2-year-old Thai female with a known case of biliary atresia with a history of Portoenterostomy (Kasai's operation) at 3-month-aged. She had a history of recurrent cholangitis at age 8 and 11 months, bleeding esophageal varices. Her PELD score was 11. Physical examination finding: Body weight 12 kg with marked jaundice and marked hepatosplenomegaly. Laboratory test finding: Hematocrit 31% platelets 131,000 per microliters, prothrombin time international normalized ratio 1.21, total bilirubin 9.6 mg/dl., albumin 2.7 g/dl. The indication for liver transplantation in this patient was the failure of Kasai's operation with recurrent cholangitis.

The living donor was her mother, a 24-year-old Thai female without any underlying disease. Physical examination was unremarkable; her laboratory test was within normal limits. Computed tomography (CT) scan and magnetic resonance imaging (MRI) showed a solid enhancing mass of about 1.6 cm at segment V, which was suspected of focal nodular hyperplasia (FNH) from correlation with the imaging characteristic (Figure 3). Estimated left lateral segment was 176.3 cm^3. The estimated GWRWR was 1.4%.

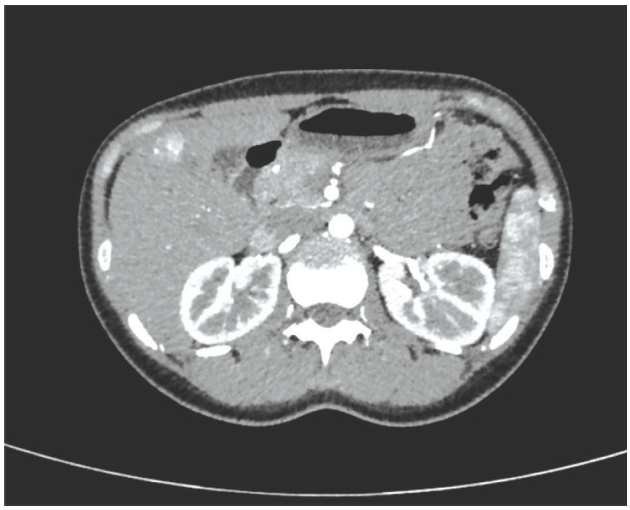

Figure 3 Contrast CT scan shows the mass size of 1.5 cm at segment V.

The recipient and donor operations were performed as standard procedures. The donor procedure was performed first to evaluate liver mass and intraabdominal organs. The segment V wedge resection was performed under intraoperative ultrasound guide and electrocautery without Pringle maneuver. The specimen was sent for pathologic examination intraoperatively. After the pathological report was confirmed to be FNH with free margin. The explanation of the recipient's liver was started simultaneously with the donor's left lateral segmentectomy. The donor's total operative time was 585 mins, and total blood loss was 300 ml. Actual left lateral segment weight was 168 grams, and actual GRWR was 1.6%.

Implant liver grafting was performed with the standard procedure – no bleeding at the cutting surface and wedge resection area after reperfusion. Total recipient operation was 570 minutes, and total blood loss was 1,500 ml.

The donor's ultrasound of the upper abdomen was performed 6 months after the surgery and showed no recurrent FNH in the period of the follow-up.

In all cases, their family did not have any other candidate living liver donors and low-rate suitable quality organs from deceased donors in our country. By ethical issues, we have approved LDLT for these cases by the institutional ethics committee and followed the Thai Red Cross's living donor rule. After that we gave family information and asked for their inform and consent.

DISCUSSION

To the best of our knowledge, this is the first reported case of an adult-to-pediatric living donor liver transplantation (LDLT) using a liver allograft with focal nodular hyperplasia (FNH). Due to lower rates of deceased organ donation in Asian countries caused by various factors, living liver donors have become increasingly important in improving recipient quality and reducing mortality rates in these regions.[1,2] In Thailand, while we continuously strive to promote and support deceased organ donation, obtaining good-quality livers suitable for pediatric split liver transplantation remains exceptionally rare each year. Consequently, our center primarily relies on living liver donors, typically parents or cousins, for pediatric liver transplantation.

FNH is the second most common benign liver tumor and has a very low recurrence rate following resection.[3] Only three cases of liver transplantation from liver allografts with FNH have been reported previously (Table 1).[4-6] These cases demonstrated no tumor recurrence and favorable outcomes. Generally, for small pediatric LDLT, the left lateral segment of the liver is sufficient. However, the functional capacity of the liver allograft must adequately meet the recipient's needs without compromising the donor. We calculated the future liver volume (FLV) after left lateral segmentectomy to be 80% of the total liver volume. The safe graft-to-recipient weight ratio (GRWR) for pediatric LDLT typically falls between 1-4%.[7,8] In these cases, as the liver tumor was small, we anticipated minimal volume loss after wedge resection without compromising the functional capacity of the liver. For safety, in the case that the tumor is in the liver graft, which will be transplanted, we estimated the tumor with a margin volume by simulating a sphere without the sphere cap volume, considering that the tumor was located on the liver surface (Figure 4). The tumor diameter was 1.5-2.5 cm, and we estimated a 1 cm margin of resection around the tumor to maximize liver volume loss. The equation calculating the sphere volume without the sphere cap volume is $4/3\pi r^3 - 1/3\pi h^2 (3r - h)$. Consequently, the estimated volume of the liver allograft after tumor resection was 168-317 cm^3, resulting in an estimated GRWR of 1.6-3.5%.

Table 1 The literature that published about liver allograft with focal nodular hyperplasia

Case No.	Author	Year	Reference	Deceased/ living donor	Adult/pediatric recipient	Whole/partial liver allograft
1	Tan M, et al	2001	(4)	Deceased	Adult	Whole
2	Gokcan H, et al.	2016	(5)	Living	Adult	Partial
3	Li G, et al.	2017	(6)	Living	Adult	Partial
Our case series	Arpornsujaritkun, et al.	2024		Living	Pediatric	Partial

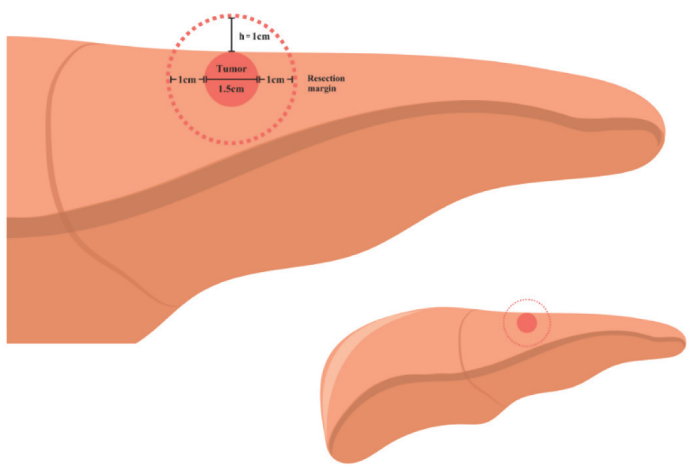

Figure 4 Simulate picture of liver tumor and margin. The tumor diameter is 1.5 cm, and the estimated margin is 1 cm around the tumor. The total diameter is 3.5 cm. The volume of the sphere without a sphere cap (V_3) is the difference between sphere volume (V_1) and sphere cap (V_2).; $V_1 = 4/3\pi r^3$, $V_2 = 1/3\pi h^2 (3r-h)$, $V_3 = V_1 - V_2 = 4/3\pi r^3 - 1/3\pi h^2 (3r-h)$.

We performed wedge resection in vivo as it provides better control over bleeding after reperfusion. In these cases, the liver tumor with the margin volume was relatively small, which did not significantly affect the left lateral segment of the liver. It is possible that the resection margin was smaller than estimated, and the cutting surface was about 1 cm away from the falciform ligament. We used these calculations and sphere volume estimation to anticipate scenarios where a more giant tumor may be encountered, necessitating a strict calculation of liver volume, particularly for the right lobe of the liver allograft. We did not observe any recurrent liver tumors one year after liver transplantation. Therefore, living donor liver allografts with FNH appear to be a feasible option for expanding liver transplantation.

The importance of liver surgery for donors with suspected FNH (Focal Nodular Hyperplasia) lies in the necessity of confirming the pathology results from a pathologist beforehand, ensuring that the nodule is indeed FNH and not another malignancy disease such as HCC (Hepatocellular Carcinoma) or liver metastasis, before proceeding with liver graft transplantation to the recipient. Therefore, when performing wedge resection of FNH, consideration should be given to obtaining a free margin of the nodule to account for the possibility of the nodule transforming into cancer.

Consequently, surgical planning and assessment of liver graft volume must be meticulously evaluated, considering the portion of the liver to be resected and ensuring an adequate future liver remnant for both the donor and recipient. In cases of other benign liver masses, consideration for liver donation may be possible if there is an assessment of adequate liver graft volume for the recipient and an adequate future liver remnant for the donor. If the pathology report confirms a benign disease, it may not necessarily be a contraindication for liver transplantation.

In terms of long-term follow-up care, FNH has a low incidence of recurrence and no malignant potential. Therefore, long-term patient care may not primarily involve imaging follow-up.

Conclusion

This report shows that the liver allograft with focal nodular hyperplasia can be safely used for transplantation. But the important thing is the confirmation of the diagnosis by a pathologist before the transplantation and the adequate future liver remnant for the recipient and donor. Previous reports show that the lesion can be left in situ with closed follow-up without any clinical difference (Table 2).

Finally, a limitation of this report is that it includes only three cases, with only one case involving a liver graft with focal nodular hyperplasia. Therefore, future studies with larger sample sizes are necessary to validate and expand upon these findings, ensuring that the results are robust and applicable to a broader population.

Table 2 The summary of the cases

No.	Total liver volume (cm^3)	Estimated liver graft volume (cm^3)	Estimated GWRWR (%)	Size of FNH (cm)	Location of FNH	Segment of liver graft	Actual graft weight (g)	Actual GWRWR (%)
1	1,126.32	230.49	1.7	1.4	IVa	Left lateral segment	250	1.8
2	1,637.3	336.5	3.7	2.3	VII	Left lateral segment	317	3.5
3	1,100	176.3	1.4	1.5	V	Left lateral segment	168	1.6

Ethical Approval

This study was reviewed and approved by the Ramathibodi Hospital Institution Review Board. No. MURA2023/690.

Conflict of Interest

The authors have no conflicts of interest to declare.

Authorship Contribution Statement

N.A. participated in research design, the writing of the paper, data collection, critical revision, and approval of the final version of the article. N.K. participated in writing the paper, data collection, analysis, and interpretation, and the article was approved. P.S., C.T., A.B., S.L., B.S., G.G., V.A., and S.S. participated in the data

acquisition and approved the article. P.C. participated in data collection and analysis.

Abbreviations

FNH – Focal Nodular Hyperplasia

LDLT – Living Donor Liver Transplantation

PELD score – Pediatrics End-stage Liver Disease score

GRWR – Graft weight to Recipient Weight Ratio

REFERENCES

1. Rela M, Reddy MS. Living donor liver transplant (LDLT) is the way forward in Asia. Hepatol Int. 2017;11(2):148-51. doi: 10.1007/s12072-016-9780-z.
2. Chen CL, Kabiling CS, Concejero AM. Why does living donor liver transplantation flourish in Asia? Nat Rev Gastroenterol Hepatol. 2013;10(12):746-51. doi: 10.1038/nrgastro.2013.194.
3. Maillette de Buy Wenniger L, Terpstra V, Beuers U. Focal nodular hyperplasia and hepatic adenoma: epidemiology and pathology. Dig Surg. 2010;27(1):24-31. doi: 10.1159/000268404.
4. Tan M, Di Carlo A, Robinson P, et al. Successful outcome after transplantation of a donor liver with focal nodular hyperplasia. Liver Transpl. 2001;7(7):652-5. doi: 10.1053/jlts.2001.23910.
5. Gokcan H, Akdogan M, Kacar S, et al. Case of a successful liver transplantation from a living donor with focal nodular hyperplasia. Acta Gastroenterol Belg. 2016;79(2):262-3.
6. Li G, Mu X, Huang X, et al. Liver transplantation using the otherwise-discarded partial liver resection graft with hepatic benign tumor: Analysis of a preliminary experience on 15 consecutive cases. Medicine (Baltimore). 2017;96(29):e7295. doi: 10.1097/MD.0000000000007295.
7. Kasahara M, Sakamoto S. Optimal graft size in pediatric living donor liver transplantation: How are children different from adults? Pediatr Transplant. 2023;27(7):e14543. doi: 10.1111/petr.14543.
8. Goldaracena N, Echeverri J, Kehar M, et al. Pediatric living donor liver transplantation with large-for-size left lateral segment grafts. Am J Transplant. 2020;20(2):504-12. doi: 10.1111/ajt.15609.

The THAI Journal of SURGERY 2024;45(3):83-89.
Official Publication of The Royal College of Surgeons of Thailand

Case Report

Primary Papillary Mucinous Carcinoma of The Scalp: A Case Report and A Brief Review of Literature

Vivek Kumar, MS
Azaz Akhtar Siddiqui, MS
Mss Harsha, MS

Department of Surgery, Lady Hardinge Medical College and Associated Smt Sucheta Kriplani Hospital, New Delhi, India

Abstract

Background: Primary papillary mucinous carcinoma of the skin is very uncommon and is seen mainly on the head and neck region. It is difficult to differentiate clinically and pathologically between these primary carcinomas of the skin and the more commonly found mucinous carcinoma distant deposits on the skin from malignancy in the breast and gastrointestinal system.

Case Presentation: We are presenting a case of a 64-year-old lady who presented with a slowly progressive, painful ulcero-proliferative growth on her scalp for 3 years. Incisional biopsy was suggestive of mucinous neoplasm. The patient underwent an oncological workup for another primary malignancy, but no other primary malignancy was detected. Subsequently, the patient underwent wide local excision with local flap reconstruction, and on the basis of the histopathology report, the diagnosis of a primary papillary mucinous carcinoma of the scalp was confirmed.

Discussion: It is a slowly progressive, low-grade carcinoma with the propensity of local tissue invasion and a high recurrence rate. Primary from head and neck, breast, gastrointestinal tract, and pelvic organ must be excluded. Treatment with wide local excision and 1 cm margin or Moh's microsurgery is advised as these are chemotherapy and radiotherapy-resistant.

Conclusion: Primary papillary mucinous carcinoma of the scalp is a rare tumor, and another primary site of mucinous neoplasm must be ruled out. Wide local excision with adequate margin is the mainstay of treatment.

Keywords: Primary papillary mucinous carcinoma, Rare carcinoma of scalp

Received for publication 2 April 2024; Revised 25 July 2024; Accepted 20 September 2024

Corresponding author: Vivek Kumar, MS, Postgraduate Resident, Department of Surgery, Ward 1 (Female Surgery Ward), Lady Hardinge Medical College and Associated Smt Sucheta Kriplani Hospital, New Delhi, India 110001; Telephone: +91 892 949 1357; E-mail: vivekdharmasya@gmail.com

Introduction

Primary papillary mucinous carcinoma of the skin is an uncommon malignancy commonly seen on the head and neck. It is very important to differentiate between primary mucinous carcinoma of the skin and the more commonly found mucinous carcinoma metastatic deposits on the skin from primaries in the breast, ovary, prostate, lung renal, and gastrointestinal systems.

Presentation of Case

A 64-year-old lady presented to our tertiary care center at Lady Hardinge Medical College with a slow-growing, painful ulcer-proliferative growth on the scalp at the right parieto-occipital region for 3 years, measuring 3 × 2.8 cm (Figure 1). The growth was firm in consistency, non-compressible, non-reducible, and fixed to the skin but slightly mobile on the skull. On examination, no lymphadenopathy or other growth in the head, neck, breast, and abdomen were found. A wedge biopsy of the growth was taken, and it showed interstitial as well as perivascular chronic inflammatory infiltrate with plasma cells. The deeper dermis shows pools of mucin with chronic inflammatory infiltrate, with few papillary structures lined by pseudostratified columnar epithelium and mild atypia. Features were consistent with mucinous neoplasia. As it was important to identify the primary mucinous neoplasm of the scalp from metastatic tumor deposit, a whole-body evaluation by clinical and radiological (CECT) was done to look for primary malignancy in other head and neck regions, breast, and gastrointestinal tract. (Figure 2-4). The patient undergoes wide local excision with a 1 cm margin and local rotational flap reconstruction of the defect and drain insertion under general anesthesia (Figure 5-8). Histopathology (Figure 9) shows hyperkeratosis, keratotic plugging, and follicular plugging in the epidermis. The dermis shows a lobulated tumor composed of cells arranged in papillary architecture separated by pools of mucin. Tumor cells are lined by tall columnar cells showing stratification at some places, round to elongated nuclei with moderate pleomorphism, irregularly distributed chromatin, and 1-2 prominent nucleoli in many cells. IHC (Figure 10-13) shows ER: positive, PR: positive, GATA 3: positive, CK 7: focal positive, CK 20: negative, p63: negative, and CK5/6: negative with the impression of papillary mucinous carcinoma. All margins were uninvolved by the tumor. Follow-up after 3 months shows a healthy site.

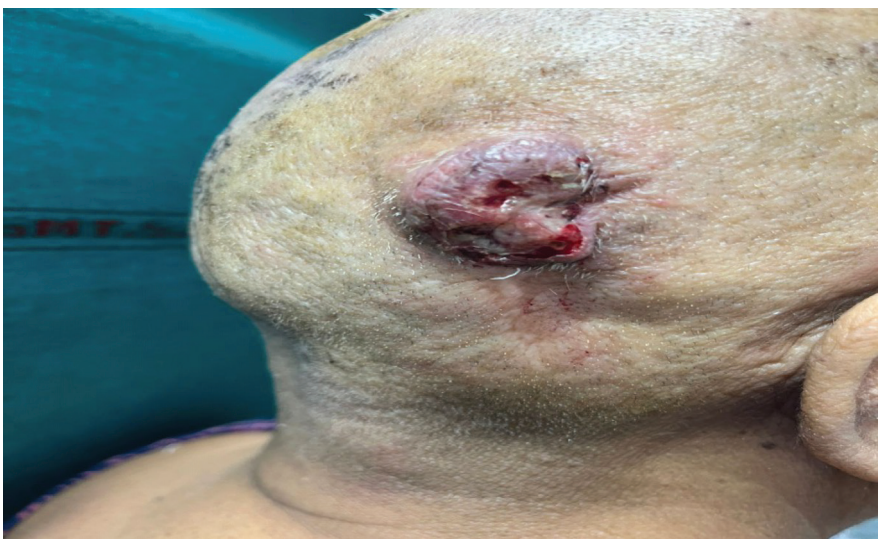

Figure 1 Showing ulceroproliferative growth on the scalp at the right parieto-occipital region

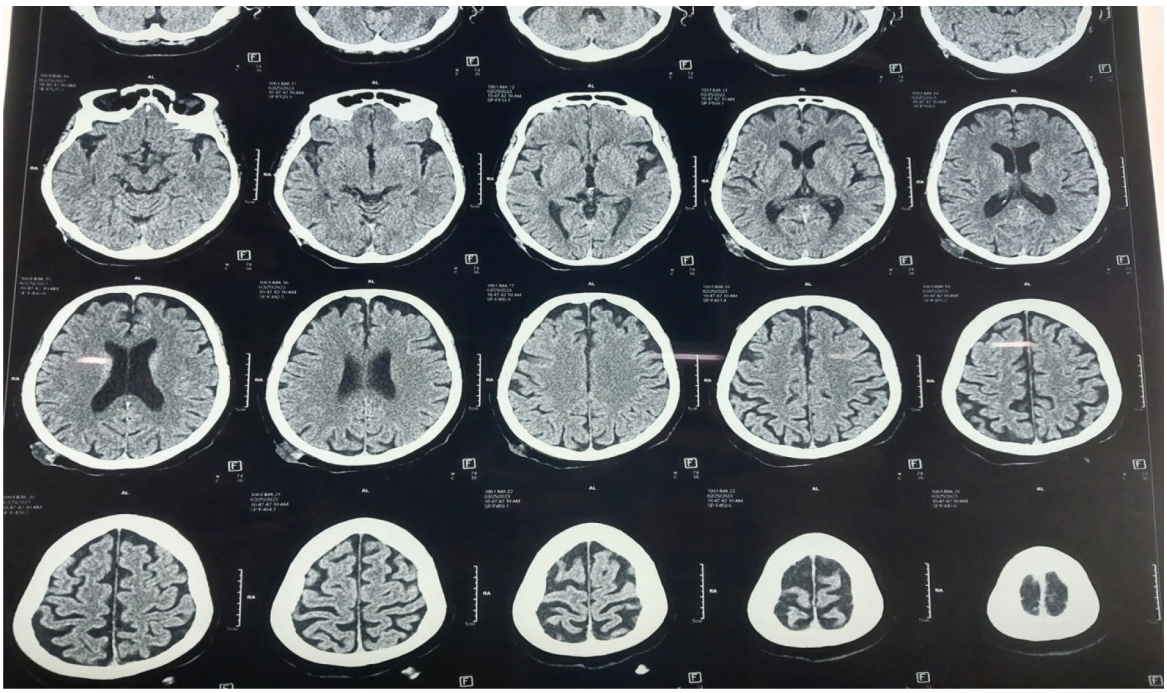

Figure 2 NCCT head showing no pericranium involvement by growth

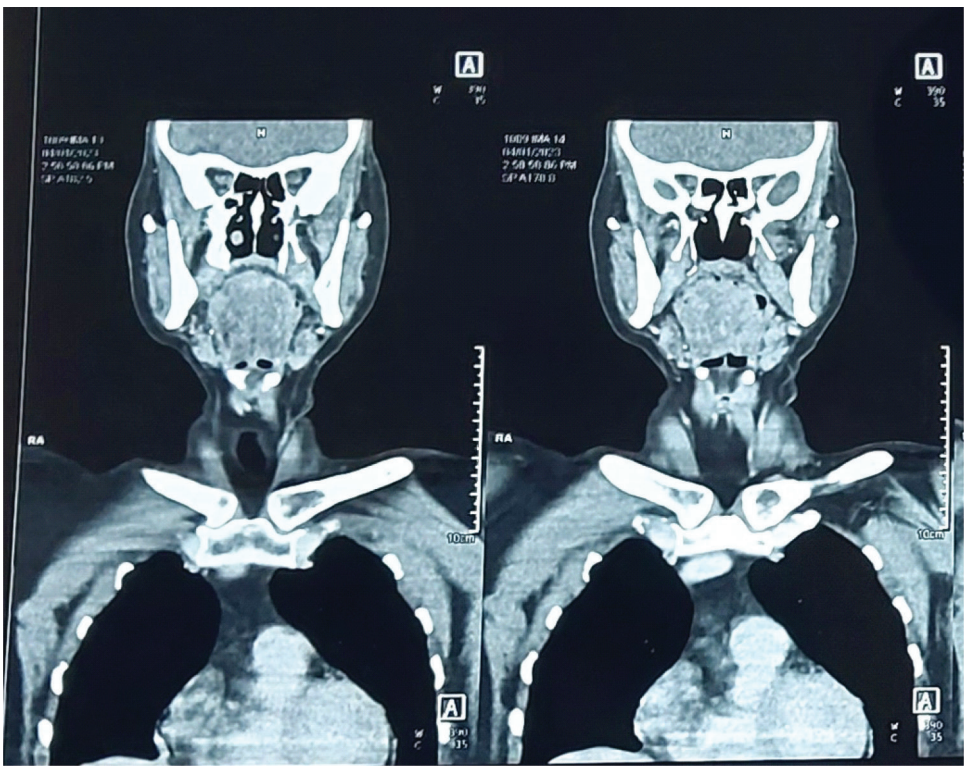

Figure 3 CECT showing no head, neck breast malignancy

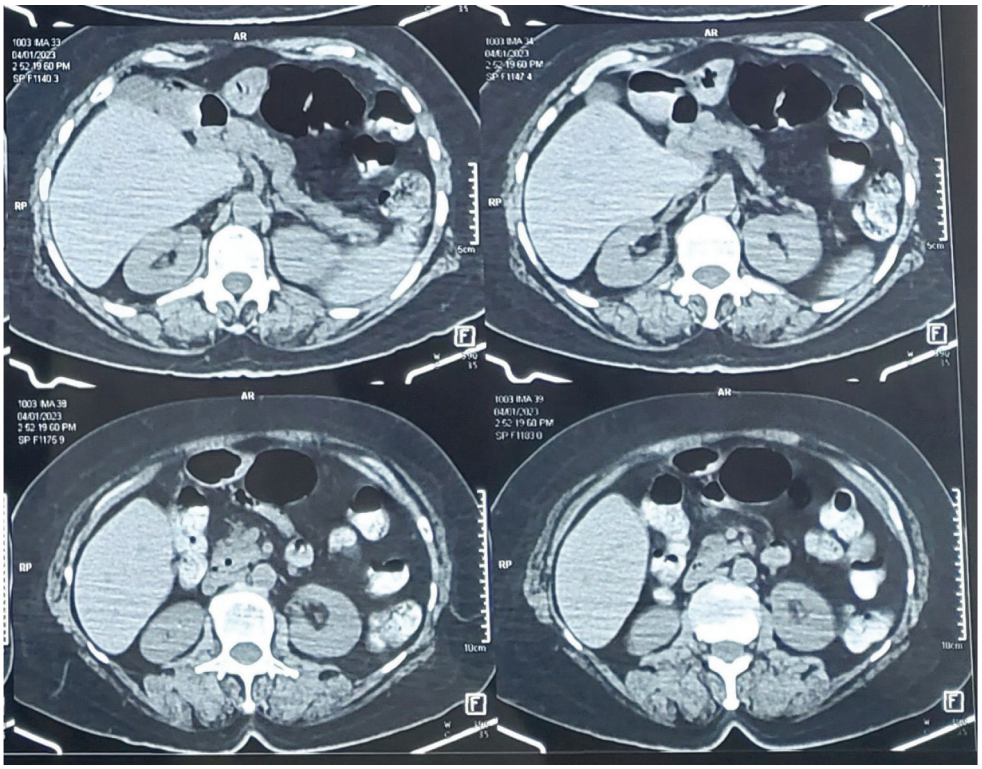

Figure 4 CECT showing no gastrointestinal tract malignancy

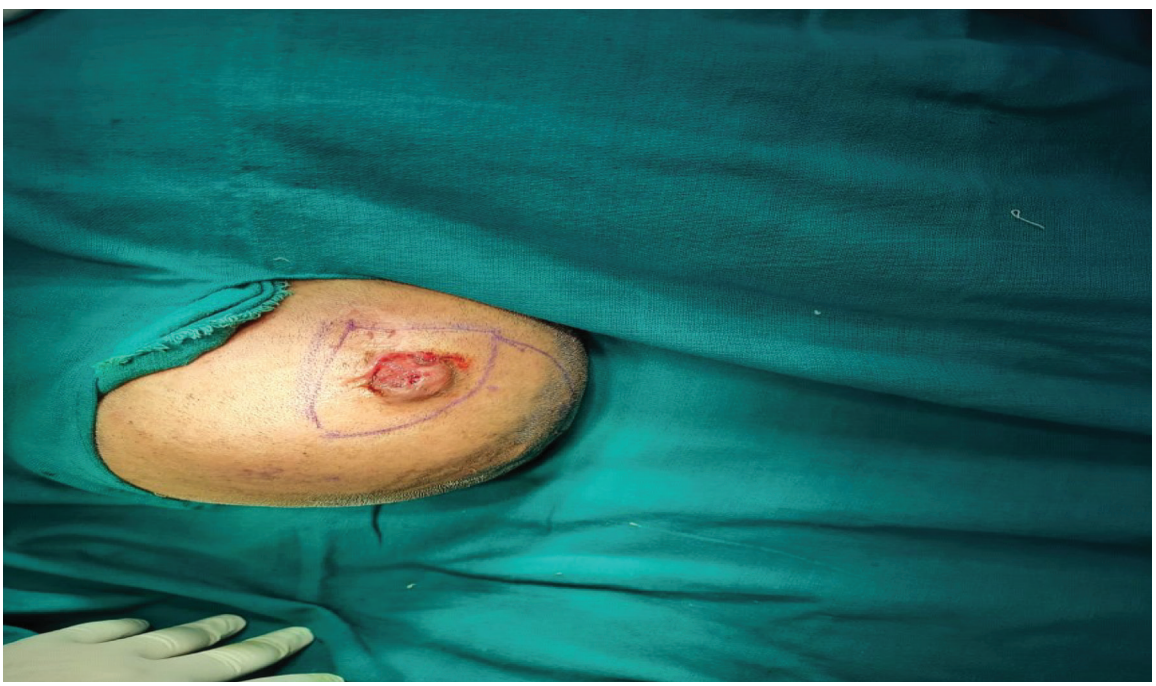

Figure 5 Showing preoperative marking for wide local excision with 1 cm margin and local rotational flap reconstruction

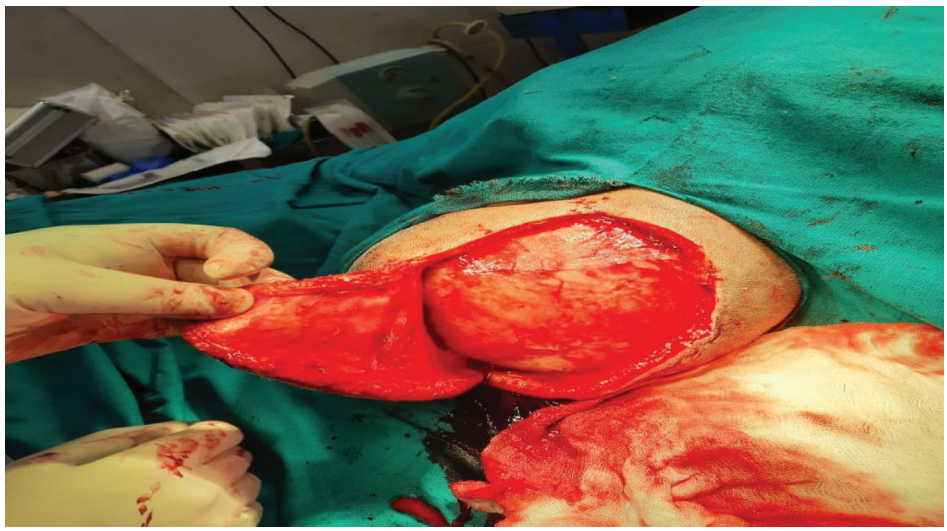

Figure 6 Showing excision of growth and creation of local rotational flap

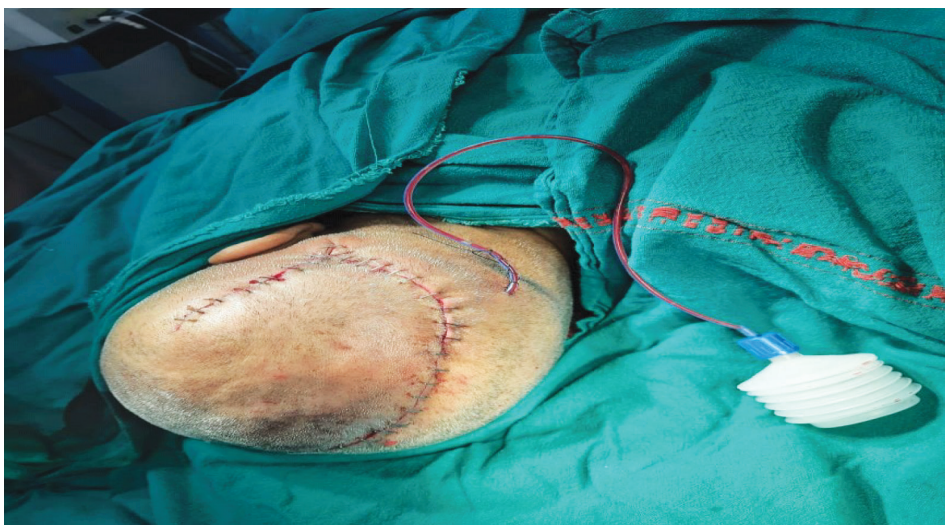

Figure 7 Showing the final reconstruction and suction drain placement beneath the flap

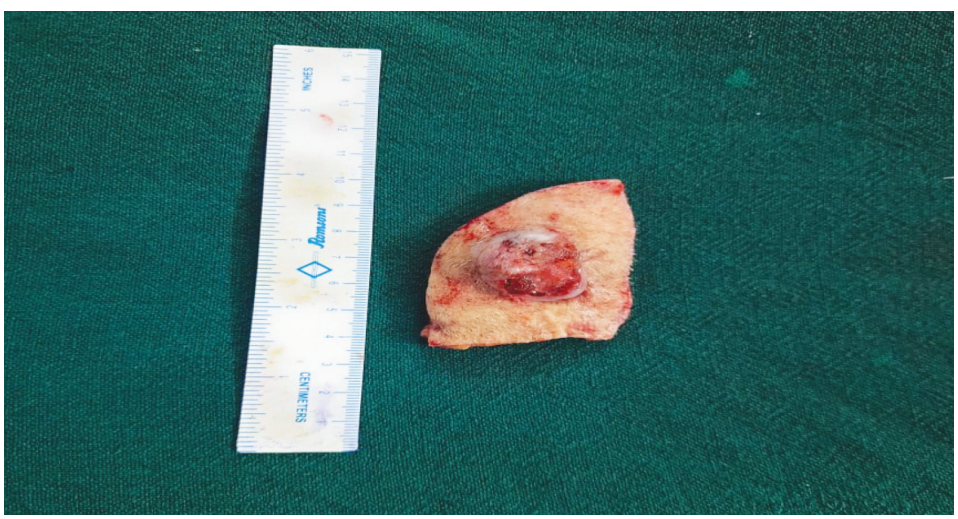

Figure 8 Showing a wide local excised specimen with 1 cm margin

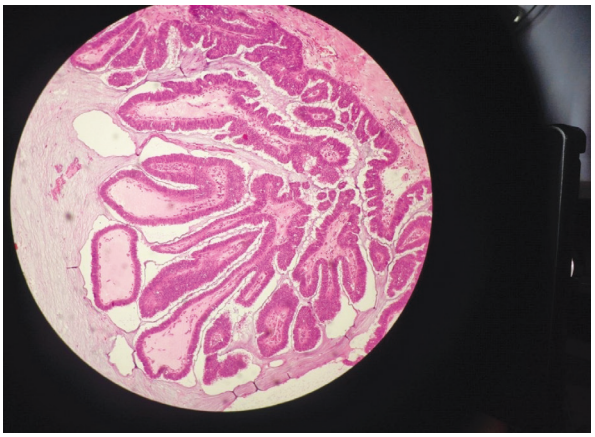

Figure 9 Histopathological image of the final resected specimen showing papillary mucinous carcinoma

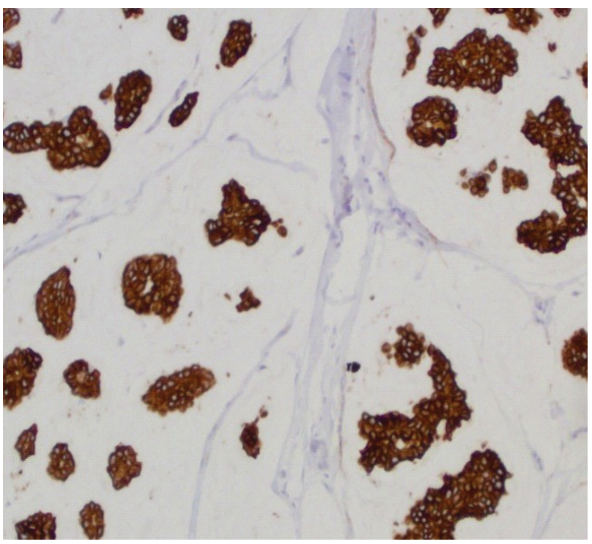

Figure 10 CK7 focal positive

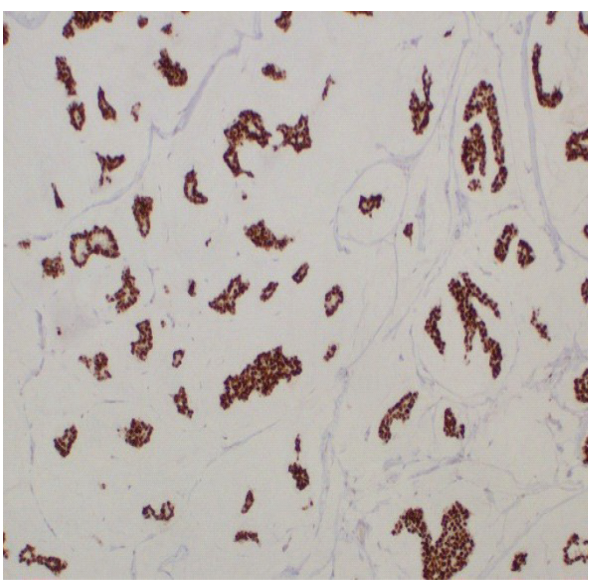

Figure 11 GATA3 positive

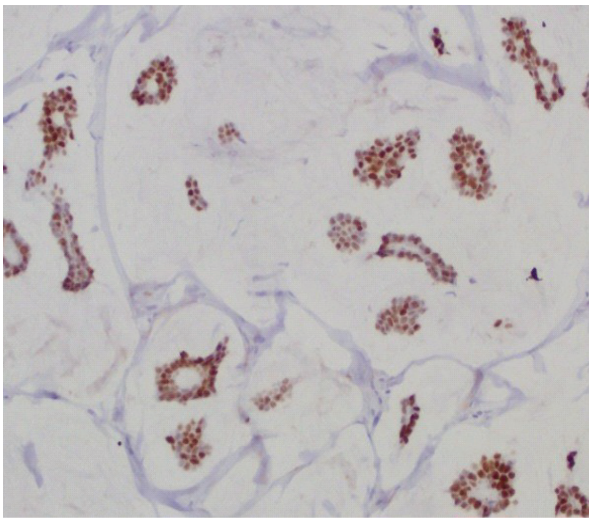

Figure 12 ER positive

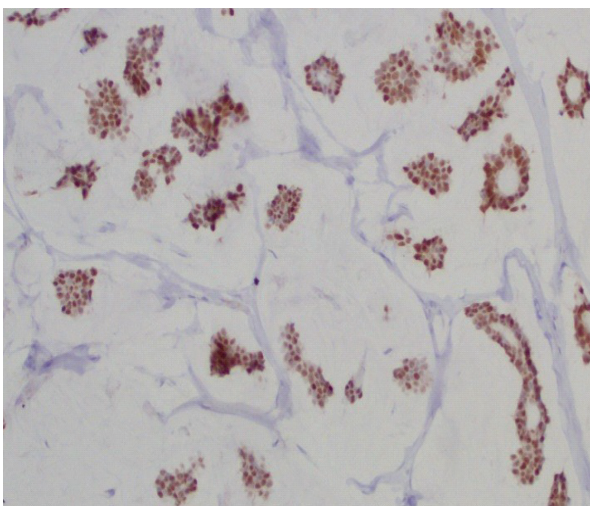

Figure 13 PR positive

Discussion

Primary papillary mucinous carcinoma of the scalp is a rare malignancy. These tumors are slow-growing, painless, soft to firm, indurated, and have ulcerated growth for a longer duration before presentation.[1] These are low-grade malignancies with high recurrence at the local site (19.6%) and a distant metastasis rate of (6.1%).[2] Metastases are commonly seen in the loco-regional lymph nodes.[3,4] In 2–7 % of cases, distant metastases have been reported.[5] Mucinous carcinoma invades local tissues by direct extension, by satellite islands of tumor, and by loco-regional lymph node involvement.[6,7] Mortality is seen due to multiple recurrences and metastatic disease.[8]

Primary skin neoplasms must be identified and differentiated from more common mucinous metastatic deposits on the skin from primaries in the breast, prostate, ovary, lungs, gastrointestinal system, and renal system.[9,10] Differentiation of secondary deposits from primary mucinous skin malignancy should be done by clinical examination, radiological evaluation, and histopathology. Surgical-wide local excision of primary with negative margin is the mainstay of treatment. To prevent a recurrence, a margin of at least 1 cm) is advised for wide local excision. Moh's micrographic surgery is a very useful procedure for achieving negative margin resection. It has been seen that these tumors are resistant to radiotherapy and chemotherapy; hence, surgery is the mainstay of treatment.[9,11]

Conclusion

Primary papillary mucinous carcinoma of the scalp is an uncommon malignancy of the scalp, and primary mucinous carcinoma of the breast, gastrointestinal system, ovary, prostate, and the renal system must be ruled out as most skin mucinous carcinoma are metastatic deposits from these primaries. It is a low-grade, slowly progressing tumor with a tendency for multiple local recurrences, regional lymph node involvement, and a low distant metastasis rate. Wide local excision with adequate margin is the mainstay of treatment as these are chemo & radioresistant.

Conflicts of Interest

There is nothing to declare.

Sources of Funding

There is nothing to declare.

Acknowledgement

Department of Pathology, Lady Hardinge Medical College, for providing histopathological images.

REFERENCES

1. Andrews TM, Gluckman JL, Weiss MA. Primary mucinous adenocarcinoma of the eyelid. Head Neck. 1992;14(4):303-7. doi: 10.1002/hed.2880140409.
2. Kamalpour L, Brindise RT, Nodzenski M, et al. Primary cutaneous mucinous carcinoma: a systematic review and meta-analysis of outcomes after surgery. JAMA Dermatol. 2014;150(4):380-4. doi: 10.1001/jamadermatol.2013.6006.
3. Chauhan A, Ganguly M, Takkar P, et al. Primary mucinous carcinoma of eyelid: a rare clinical entity. Indian J Ophthalmol. 2009;57(2):150-2. doi: 10.4103/0301-4738.45509.
4. Cabell CE, Helm KF, Sakol PJ, et al. Primary mucinous carcinoma in a 54-year-old man. J Am Acad Dermatol. 2003;49(5):941-3. doi: 10.1016/s0190-9622(02)61524-5.
5. Ajithkumar TV, Nileena N, Abraham EK, et al. Bone marrow relapse in primary mucinous carcinoma of skin. Am J Clin Oncol. 1999;22(3):303-4. doi: 10.1097/00000421-199906000-00019.
6. Latorre A, Alghothani L, Lambert D, et al. Mucin-producing Malignant Tumor of Lower Eyelid Presenting in a 14-year-old Patient. J Clin Aesthet Dermatol. 2012;5(4):44-7.
7. Wick MR, Goellner JR, Wolfe JT 3rd, et al. Adnexal carcinomas of the skin. I. Eccrine carcinomas. Cancer. 1985;56(5):1147-62. doi: 10.1002/1097-0142(19850901)56:5<1147::aid-cncr2820560532>3.0.co;2-3.
8. Durairaj VD, Hink EM, Kahook MY, et al. Mucinous eccrine adenocarcinoma of the periocular region. Ophthalmic Plast Reconstr Surg. 2006;22(1):30-5. doi: 10.1097/01.iop.0000192635.87120.4e.
9. Kelly BC, Koay J, Driscoll MS, et al. Report of a case: primary mucinous carcinoma of the skin. Dermatol Online J. 2008;14(6):4. doi: 10.5070/D32fk659r0.
10. Urso C, Bondi R, Paglierani M, et al. Carcinomas of sweat glands: report of 60 cases. Arch Pathol Lab Med. 2001;125(4):498-505. doi: 10.5858/2001-125-0498-COSG.
11. Coan EB, Doan A, Allen C. Mucinous eccrine carcinoma: a rare case of recurrence with lacrimal gland extension. Ophthalmic Plast Reconstr Surg. 2012;28(5):e109-10. doi: 10.1097/IOP.0b013e31823c80ba.

The THAI Journal of SURGERY 2024;45(3):90-97.
Official Publication of The Royal College of Surgeons of Thailand

Case Report

Use of Modified V-Y Latissimus Dorsi Myocutaneous Flap for Closure of Huge Anterior and Posterior Chest Wall Reconstruction, Our Experience: A Case Report

Zaabar Nabilah, MBBS[1,2,3,4]
Yuen Wen Adzim Poh, MD, MS (Plastic Surgery)[1]
Mat Saad Arman Zaharil, MS (Plastic Surgery)[1]
Phong Jhiew Khoo, MD[1]

[1] *Plastic and Reconstructive Unit, Department of Surgery, Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia, Malaysia*
[2] *Reconstructive Sciences Unit, Hospital Universiti Sains Malaysia, Kota Bharu, Malaysia*
[3] *Plastic and Reconstructive Surgery, Universiti Sains Malaysia School of Medical Sciences, Kota Bharu, Malaysia*
[4] *Department of Plastic and Reconstructive Surgery, Hospital Kuala Lumpur, Malaysia*

Abstract Reconstruction of chest wall defects after tumor resection is challenging. With the advancement of reconstructive surgery, more options are available for chest wall reconstruction. Workhorse flaps like the musculocutaneous latissimus dorsi flap are frequently employed. Its modification to the V-Y design of the latissimus dorsi myocutaneous flap allows huge chest wall defect closure with substantial benefits, especially for cancer patients. We describe our experience using this flap design in five patients and the difficulties we faced. All patients underwent immediate chest wall reconstruction with a modified V-Y latissimus dorsi myocutaneous flap with minimal complications and donor site morbidity.

Keywords: Modified V-Y latissimus dorsi flap, Chest wall reconstruction, Breast reconstruction

Introduction

Significant chest wall defects frequently occur after resection of malignant tumors like breast carcinoma or sarcoma.[1] Late detection of these tumors is common, especially in Asian countries, often presenting as large, ulcerated masses requiring complex reconstruction after removal. Surgical management is often debated among surgeons and oncologists to ensure complete excision while optimizing cosmetic outcomes.

The conventional latissimus dorsi (LD) myocutaneous flap was modified to a V-Y skin island design, allowing closure of substantial anterior and posterior chest wall total thickness defects without causing donor site morbidity or need for skin grafting with acceptable cosmesis.[2] This provides a reliable single-stage reconstructive option and is particularly beneficial where microsurgical expertise is limited.

Received for publication 11 May 2024; Revised 4 August 2024; Accepted 20 September 2024

Corresponding author: Yuen Wen Adzim Poh, MD, MS (Plastic Surgery), Department of Surgery, Plastic and Reconstructive Unit, Hospital Canselor Tuanku Muhriz, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Wilayah Persekutuan Kuala Lumpur; E-mail: adzimpoh@gmail.com; Telephone: +60193850815

Modifications to the skin island design have further expanded its utility[3] and its ability to withstand radiotherapy and chemotherapy further proves its superiority. We describe our experience with the modified V-Y LD flap for huge anterior and posterior chest wall reconstruction.

Materials and Methods

Between January 2022 and March 2023, 5 patients aged 37-74 (mean 49.8) underwent chest wall reconstruction with an extended V-Y LD myocutaneous flap. Comorbidities were present in some patients. After discussion with the primary tumor team, patients were selected based on defect size and location.

Two patients who had breast carcinoma underwent mastectomy ± axillary clearance, while three sarcoma patients had wide local excision. All patients underwent immediate reconstruction due to the anticipated huge defect after wide excision that necessitated definitive soft tissue coverage. The flap was designed pre-operatively while the patient was in a lateral or erect position, arm ipsilateral to the tumor in 90 degrees abduction, similar to the conventional design of the latissimus dorsi flap with careful consideration towards the pedicle, the thoracodorsal artery. However, the difference lay in the skin island design that was drawn akin to an isosceles triangle for its lateral borders, and the flap was oriented either in vertical, horizontal, or oblique direction following the defect. Next, the distal end of the flap is marked at the meeting point of the two lateral borders, signifying the leading edge. Margins were confirmed, and the primary tumor team excised the tumors and subsequently handed them over to the plastic reconstructive surgeon.

The patient was positioned in lateral decubitus for flap harvest. The incision was deepened until LD was visualized. The modified V-Y LD flap was raised while preserving the thoracodorsal artery. The flap inset was adjusted for tension-free defect coverage without pedicle compromise. The skin island and donor site were sutured in 2 layers; dermal and skin layers. Drains were placed underneath the flap and donor site to prevent fluid collection. The donor site that could not be closed was skin-grafted. The drains were removed after a reduced output trend of less than 30 cc/day was observed.

Patients were monitored closely for vascular compromise and signs of infections by administering intravenous antibiotics until all drains were removed. Patients were nursed in lateral or supine positions to prevent tension and pressure. Flaps were kept warm, and arm elevation and shoulder abduction were avoided. Patients were discharged and followed up until satisfactory healing before referral for adjuvant therapy after histopathology reports.

Patients

Case 1: An unstable elderly patient with comorbidities came with fungating bleeding recurrent breast carcinoma and underwent simultaneous tumor excision and flap raise. The donor site was grafted. Intraoperative complications required transfusion, inotropes, and ICU admission for weaning: postoperative graft loss due to supine positioning and wound breakdown at the leading edge of the flap due to tension. The patient initially improved with conservative management, and secondary suturing was attempted but later died from disease progression (Figure 1).

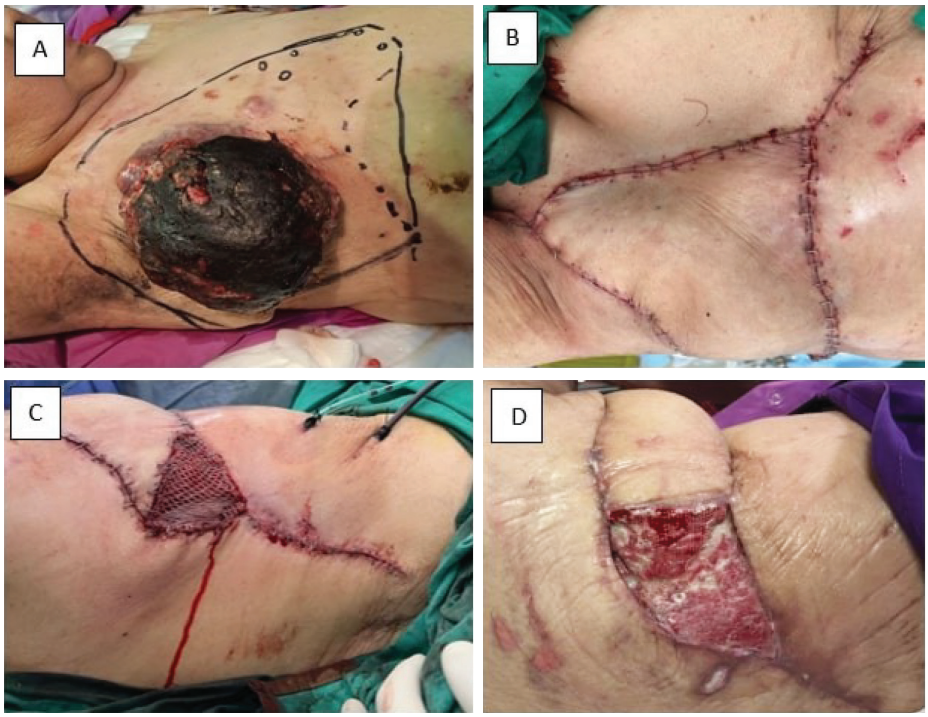

Figure 1 A) Bleeding fungating breast carcinoma, B) Modified V-Y latissimus dorsi flap after flap inset, C) Tail end of the flap was grafted with a split skin graft due to large defect with tension, D) Failed graft uptake due to shearing and pressure at the site.

Case 2: A patient with metastatic breast cancer unresponsive to chemotherapy underwent tumor excision, axillary clearance, and flap raise/inset—an uneventful perioperative period (Figure 2).

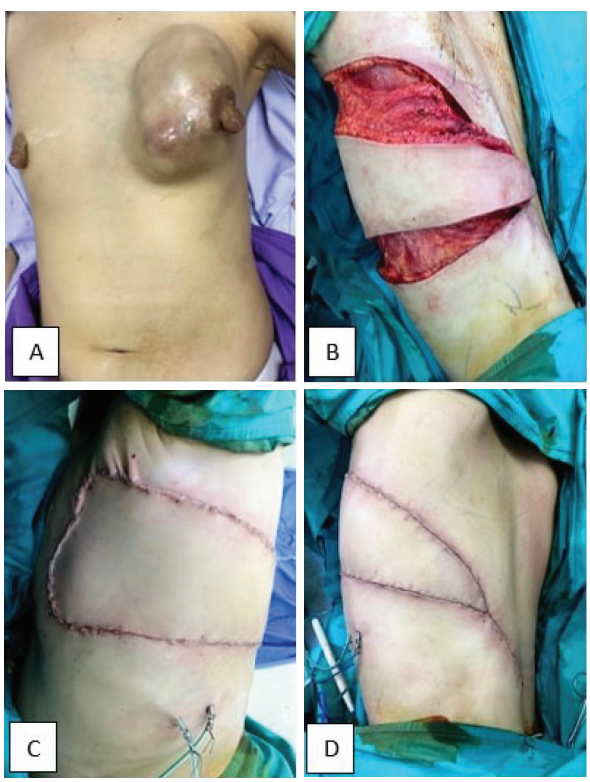

Figure 2 A) Fungating left breast invasive carcinoma at presentation, B) Modified V-Y latissimus dorsi flap was raised with skin island oriented horizontally in triangular shape, C) Anterior chest wall recipient site after closure, D) Primary closure of donor site

Cases 3-4: Patients with back sarcomas underwent wide excision, and the flap was orientated obliquely and vertically, respectively. Minor tip necrosis in one patient was managed conservatively (Figures 3-4).

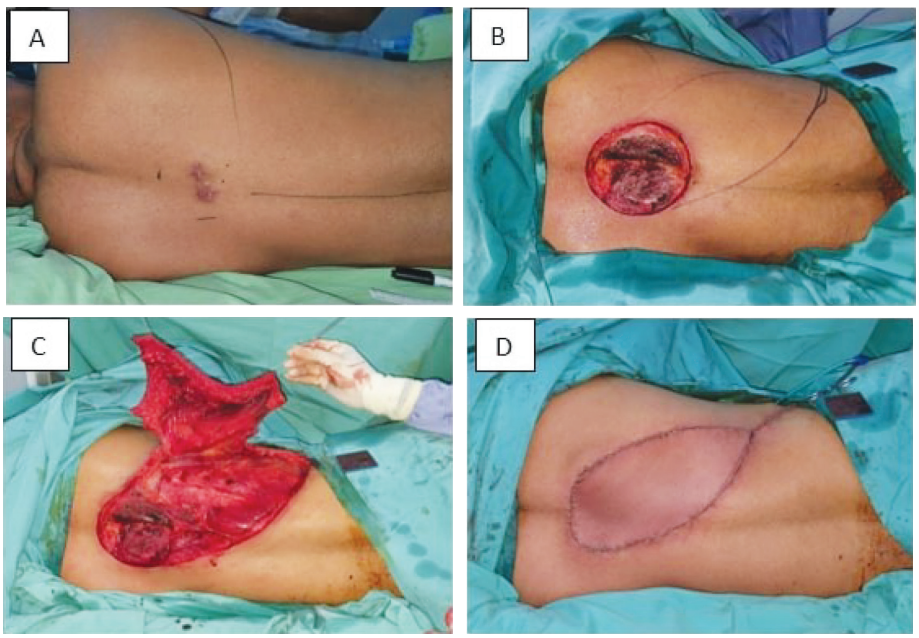

Figure 3 A) Third patient with upper back DFSP at the midline, B) wound bed post tumor resection exposing the fascia, C) Flap was raised and inset, D) Closure

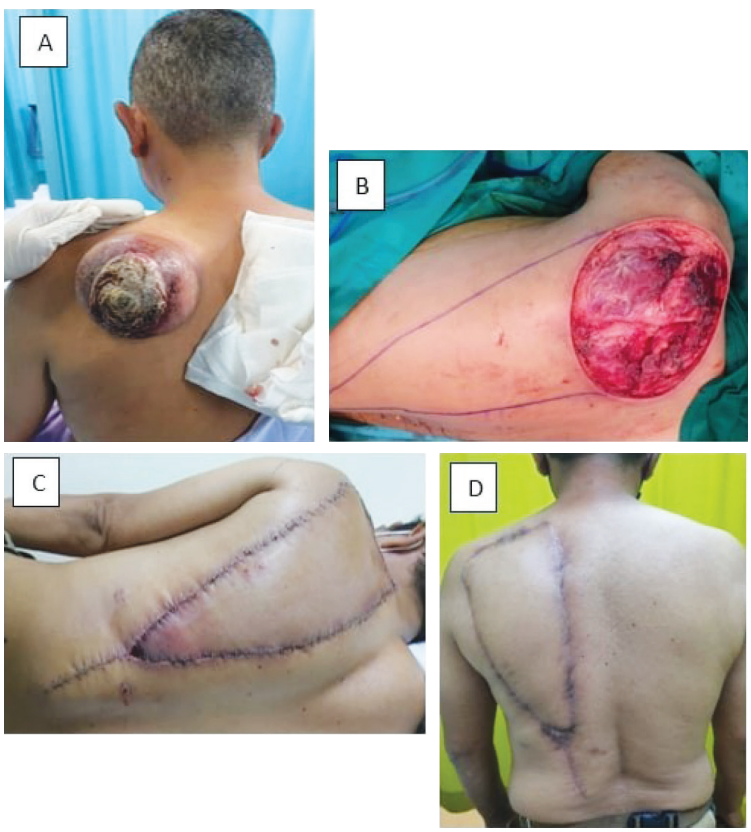

Figure 4 A) Fourth patient with ulcerated fungating upper back DFSP, B) Intraoperatively, 15x15cm defect, C) Tail end necrosis which was observed till well-demarcated, D) Secondary healing of distal end with dressing

Case 5: The patient with extensive back sarcoma underwent tumor excision, laminectomy, and vertical flap raise. Prone/lateral nursing prevented flap pressure. Wound dehiscence at the leading edge due to tension failed to close despite intervention complicated with recurrence despite margin-free excision (Figure 5).

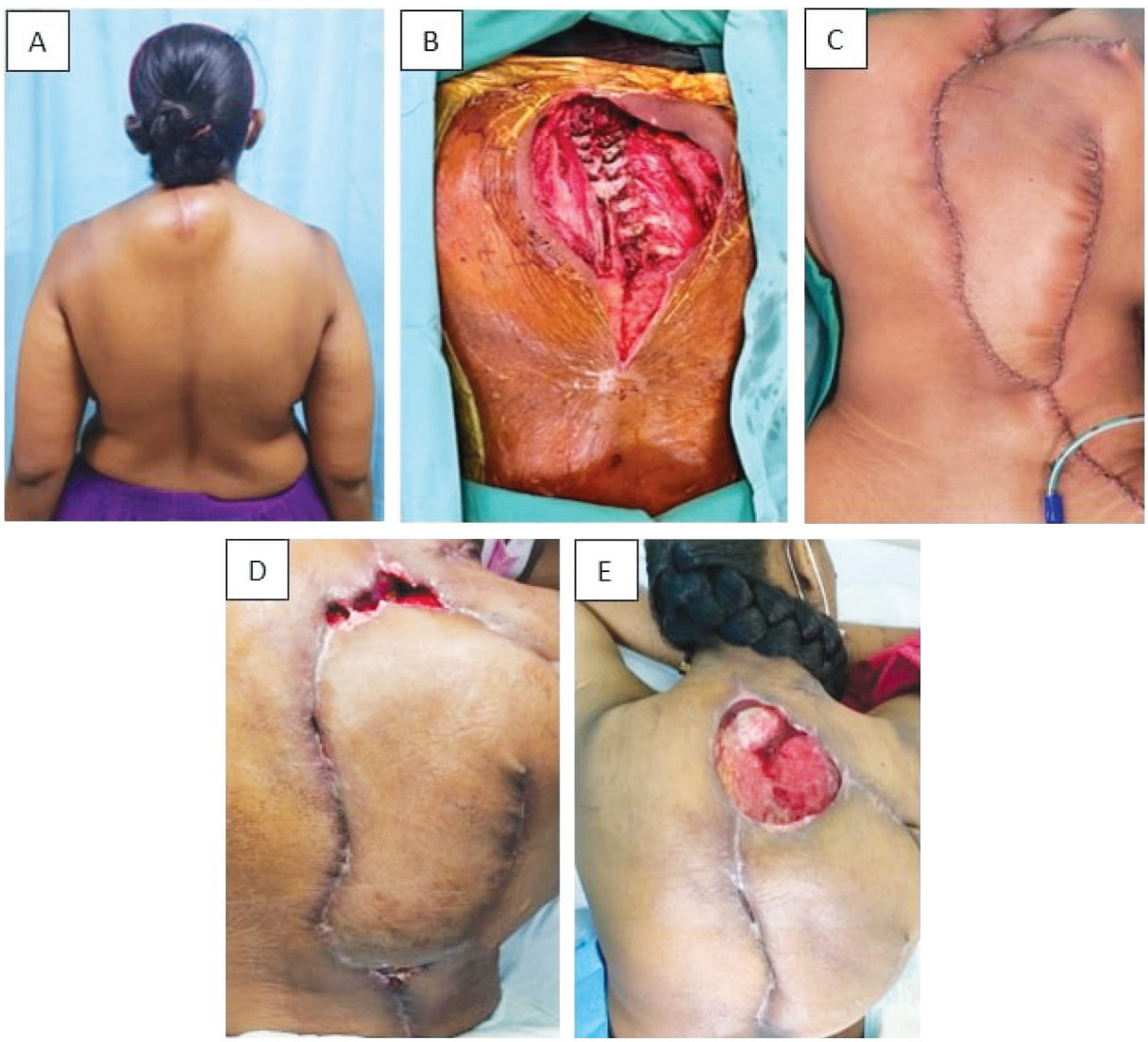

Figure 5 A) Upper back sarcoma, B) Post wide excision with exposed spine, C) After flap inset, D) Wound dehiscence at leading edge and tail end of flap, E) Tumour recurrence

Results

Three patients had good outcomes, adjuvant therapy was not delayed after complete healing, and no significant infections/flap losses occurred One elderly patient developed multiple systemic complications and finally succumbed due to disease progression. One patient had a wound breakdown at the leading edge and distal tip with eventual recurrence at the tumor bed. Overall, patients were satisfied with outcomes, flap appearance, and donor site. The patients were followed up after surgery until after suture removal on day 14 or until satisfactory wound healing and were sent for oncological management by the primary team. The patient's background, operative summary, histopathology, and outcomes are summarized in Table 1.

Table 1 Summary of patients, operation, histopathology, and outcomes

No.	Age (Years)	Comorbidities	Functional status (ECOG)	Tumour location	Diagnosis	Operation	Duration of surgery, skin-to-skin (minutes)	Estimated blood loss (ml)	Defect size (cm)	Wound bed	Histopathology	Outcomes
1	74	Hypertension Dyslipidaemia Chronic Kidney Disease Rheumatoid arthritis with pulmonary fibrosis History of cerebrovascular accident Post-neoadjuvant chemotherapy, right mastectomy and axillary clearance	2	Anterior	Recurrent bleeding mastectomy fungating metastatic right breast carcinoma	Toilet mastectomy	345	1,200	15 × 20	Muscle	Invasive breast carcinoma	1) Failed uptake of split skin graft at donor site due to the ill condition of patient and graft shearing and pressure on supine position - dressing, allograft application 2) Wound dehiscence at the leading edge - dressing, debridement and secondary suturing 3) Death due to the progression of the disease
2	48	Post neoadjuvant chemotherapy	1	Anterior	Metastatic left carcinoma	Toilet mastectomy and axillary clearance	85	150	14 × 14	Muscle	Invasive breast carcinoma	Would well healed
3	37	Hypertension Dyslipidaemia	1	Posterior	Upper back sarcoma	Wide local excision	115	100	9 × 9	Fascia	Dermatofibrosarcoma Protuberans (DFSP)	Would well healed
4	49	Diabetes mellitus Dyslipidaemia	1	Posterior	Upper back sarcoma	Wide local excision	275	120	15 × 15	Muscle	Dermatofibrosarcoma Protuberans (DFSP)	Tail end necrosis - dressing, secondary healing
5	41	No known medical illness	1	Posterior	Upper back sarcoma	Wide local excision and laminectomy	570	500	20 × 30	Bone	High-grade Malignant Peripheral Nerve Sheath Tumour (MPNST)	1) Tail end necrosis 2) Recurrent wound dehiscence at the leading edge - dressing, negative pressure wound therapy, secondary suturing 3) Recurrent wound dehiscence at the tumour site

Discussion

There are many ways for chest wall defect coverage using a pedicle or free flap. Common flaps traditionally used include pedicle transverse rectus abdominis myocutaneous (TRAM) flap, pedicle latissimus dorsi (LD) myocutaneous flap, and free anterolateral thigh (ALT) flap. These flaps are beneficial as they provide versatility, resilience, and durability for tissue coverage and can withstand chemo and radiotherapy post-operatively. However, the donor site morbidity is significant if a large flap design is required; the inability for primary closure and wound breakdown due to tension, weakness of abdominal wall, hernia, and distal end necrosis in TRAM flap due to limited vascularity and pedicle length. Bostwick et al observed that the latissimus dorsi flaps with skin islands more than 12 cm in width required skin grafts for closure for donor sites in thin patients with very little skin elasticity of the back, whereas in obese patients, it is possible to close the donor site using a conventional elliptical design.

The role of reconstructive surgery in large chest wall tumors has reached a greater height due to the improvement of flap design by varying the shape of the skin island. Since the introduction of the modified V-Y LD flap in the 1990s by Micali and Carramaschi,[4] it has enabled surgeons to embark on more challenging, previously "unresectable" tumors to achieve a negative histological margin and cosmetically acceptable wound coverage.[5]

The triangular design of the modified V-Y LD myocutaneous flap is innovative as it can cover a larger defect than the conventional LD flap while being manipulated in different orientations to fit into the defect, the ability to close the donor site primarily without skin graft, and in delayed reconstructions with previous radiotherapy, the skin territory is far away from the irradiated fields.[6,7]

In this case series, all 5 patients had aggressive malignancies. The choice for this flap selection was made based on patient and surgeon's factors. The patient's factors include age, comorbidities, and functional status. Subjecting some of these patients to long hours of surgery had a free tissue transfer and microsurgery been performed would have been detrimental due to prolonged exposure to anesthesia, bleeding, hypothermia, cardiorespiratory compromise, and long intensive care unit stay. As for the surgeon's factor, our center has a single surgeon with limited microsurgical expertise and intensive care facilities. Thus, reconstruction with a pedicle flap is preferred.

Based on our encounters, the main difficulty was wound dehiscence at the leading edge of maximum tension. This is mainly attributed to the excision of extensor muscles of the back, causing the patient to be in persistent trunk flexion, which could have been prevented with a suitable brace that was not prepared in advance due to financial and logistic issues. Repeated efforts to downsize the wound with NPWT and secondary suturing proved to be futile and was further aggravated with rapid tumor recurrence.

Another challenge was nursing patients in proper positioning. It was especially hard for the post-operative patients to continue lying in prone or lateral positions due to the discomfort; elderly patients are especially at risk. The patients were also advised against arm abduction as stretching and direct pressure on the flap can cause flap/tip necrosis.

Other complications like hematoma, seroma, and infections should be monitored and managed promptly.[8] In all of our 5 patients, we did not encounter these problems. Patients must be counseled regarding expected outcomes. Careful preoperative planning and postoperative nursing can help optimize outcomes.

Conclusion

The modified V-Y LD flap provides reliable, low-risk coverage of significant defects for patients, avoiding microsurgical procedures with more predictable outcomes. Careful postoperative positioning and pressure avoidance are critical to prevent wound dehiscence, morbidity, and faster recovery.

Patient Consent

The patient's consent has been obtained before this report. The consent form states that the patient consented to disclose her images and other clinical information in the report. The patient also understands that the message will not include her name and initials. Due efforts will be ensured to conceal their identity, but anonymity cannot be guaranteed.

Funding

Nil

Conflicts of Interest

None

REFERENCES

1. Lim YX, Lim ZL, Ho PJ, et al. Breast Cancer in Asia: Incidence, Mortality, Early Detection, Mammography Programs, and Risk-Based Screening Initiatives. Cancers (Basel). 2022;14(17):4218. doi: 10.3390/cancers14174218.
2. Mansour KA, Thourani VH, Losken A, et al. Chest wall resections and reconstruction: a 25-year experience. Ann Thorac Surg. 2002;73(6):1720-6. doi: 10.1016/s0003-4975(02)03527-0.
3. Christen T, Koch N, Philandrianos C, et al. The V-Y latissimus dorsi musculocutaneous flap in the reconstruction of large posterior chest wall defects. Aesthetic Plast Surg. 2012;36(3):618-22. doi: 10.1007/s00266-011-9866-x.
4. Micali E, Carramaschi FR. Extended V-Y latissimus dorsi musculocutaneous flap for anterior chest wall reconstruction. Plast Reconstr Surg. 2001 May;107(6):1382-92. doi: 10.1097/00006534-200105000-00010.
5. Munhoz AM, Montag E, Arruda E, et al. Immediate locally advanced breast cancer and chest wall reconstruction: surgical planning and reconstruction strategies with extended V-Y latissimus dorsi myocutaneous flap. Plast Reconstr Surg. 2011;127(6):2186-2197. doi: 10.1097/PRS.0b013e318213a038.
6. Woo E, Tan BK, Koong HN, et al. Use of the extended V-Y latissimus dorsi myocutaneous flap for chest wall reconstruction in locally advanced breast cancer. Ann Thorac Surg. 2006;82(2):752-5. doi: 10.1016/j.athoracsur.2005.07.030.
7. Dai Z, Maihemuti M, Sun Y, et al. Resection and reconstruction of huge tumors in the chest wall. J Cardiothorac Surg. 2022;17(1):116. doi: 10.1186/s13019-022-01877-9.
8. Lans TE, van der Pol C, Wouters MW, et al. Complications in wound healing after chest wall resection in cancer patients; a multivariate analysis of 220 patients. J Thorac Oncol. 2009;4(5):639-43. doi: 10.1097/JTO.0b013e31819d18c9.