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EDITORIAL

ORIGINAL ARTICLES

CASE REPORTS

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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.

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- 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.

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- 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).

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

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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.

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

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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.

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Editorial

Potchavit Aphinives, MD

Editor-in-Chief of The Thai Journal of Surgery

Welcome to the second issue of 2024; there are 2 case reports. First is a rare case of Mitten hand contracture from Malaysia. Some readers may wonder about the rationality of surgical treatment. I assure you about several interesting aspects and down-to-earth situations that we (as surgeons) have to face every day. The second is a pathogenic germline variant in the BRCA2 gene in a patient with DCIS from Songkla University. There are 3 original articles, one RCT about hernia repair with/without fixation, one case series of surgical revascularization for acute lower limb ischemia, and the last article about factors influencing postoperative outcomes in surgical residents' minor surgeries.

Next month, the 49th Annual Scientific Congress of The Royal College of Surgeons of Thailand will take place at Royal Cliff Hotels Group, Pattaya. Besides updating surgical knowledge, this event is also the best opportunity for our fellows to reunite after graduation.

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Original Article

Comparison of Mesh Fixation and Non-fixation in Totally Extraperitoneal Hernia Repair: A Randomized Controlled Trial

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Abstract

Objective: Many studies have shown that non-fixation of mesh in laparoscopic totally extraperitoneal (TEP) inguinal hernia repair is safe and has no disadvantage compared to mesh fixation; however, most studies contain limited information on hernia-defect size. The purpose of this study was to compare the clinical outcome of non-fixation and fixation of mesh in consecutive elective laparoscopic TEP inguinal hernia repair in any type and size of hernia defect classified by the European Hernia Society (EHS) groin hernia classification to be a part of the level 1 evidence about technique of fixation in TEP.

Patients and Methods: One hundred and ten hernia repairs in 101 patients were enrolled in the trial between July 2022 and August 2023. The patients were randomized to the mesh fixation group (n = 55) or the non-fixation group (n = 55). The primary outcomes were chronic groin pain and recurrence at 6 months. The secondary outcomes were operative time, conversion rates, pain scores, analgesic requirement, time to regular activity, complications, and length of stay. A person blinded to the method of fixation performed statistical analysis.

Results: There were no significant differences between the two groups in baseline demographic characteristics, including age, BMI, sex, ASA classification, EHS hernia classification, and incidence of recurrent defect. More than 90% of hernia defects were larger than 1.5 cm, and more than 25% of defects were > 3 cm. They were statistically similar in both groups in terms of chronic groin pain, operative time, conversion rates, pain scores, analgesic requirement, time to regular activity, length of stay, and complications. Neither group had a recurrence at a minimum follow-up of 6 months.

Conclusions: There was no statistical significance in chronic groin pain and recurrence between fixation and non-fixation groups. The non-fixation approach should be adopted routinely and safely in laparoscopic TEP hernia repair. Even the tack fixation technique applied in this study was not associated with the risk of significant pain level and chronic groin pain; however, it is associated with high operative cost, so it should be used only in very selected situations in TEP.

Keywords: Laparoscopic inguinal hernia repair, TEP, The EHS groin hernia classification, Mesh fixation, Non-fixation

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Introduction

Laparoscopic total extraperitoneal (TEP) inguinal hernia repair has become one of the gold standards for inguinal hernia repair.[1-3] It is associated with less postoperative pain, faster recovery, and earlier return to work.[4] In the past, fixation of the mesh was a logical step to prevent mesh migration and folding. While mesh fixation was an important step to reduce hernia recurrence, there are studies indicating that fixation can lead to many complications, especially postoperative chronic pain.[5] In 1999, Ferzil et al. demonstrated the safety of non-fixation of mesh during laparoscopic surgery in TEP. Since then, numerous studies have shown the reliability of non-fixation of mesh in TEP.[6] According to systematic review and meta-analysis, 25 trials with 3,668 patients (4,038 hernias) were included; mesh non-fixation improves the return to daily life without increasing the risk of hernia recurrence or chronic pain.[7] However, most of the studies contain only limited information on hernia-defect size,[8] and a majority of hernia defects were small in some studies.[9]

This randomized controlled study was conducted to compare the clinical outcome of non-fixation and mesh fixation in consecutive elective laparoscopic TEP inguinal hernia repair in any type and size of the hernia defect, including large direct and recurrence defects. To study the feasibility of non-fixation in larger defects of inguinal hernias, the primary endpoints were chronic groin pain and recurrence at 6 months.

Patients and Methods

A randomized controlled trial was carried out between July 2022 and August 2023 by a single surgeon who had already performed > 150 laparoscopic hernia repairs. Approval from the hospital ethics committee was obtained to carry out the study, and the patients' written consent was obtained. Patients who came to OPD with inguinal hernia were evaluated and excluded if under 18 years, unfit for general anesthesia, irreducible hernia, low midline surgical scar, cognitive impairment, and contraindication for NSAIDs used. The flow of patients is shown in Figure 1. The primary endpoints were chronic groin pain and recurrence at 6 months. The secondary endpoints were operative time, conversion rates, pain scores, analgesic requirement, time to regular activity, complications, and length of stay.

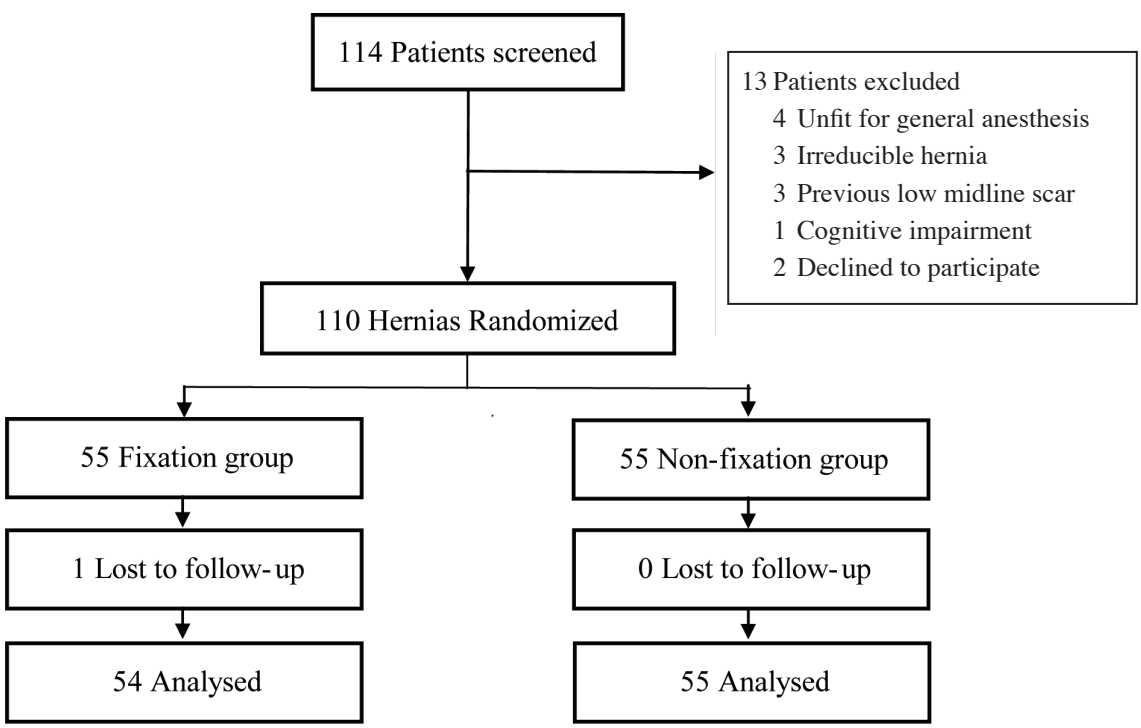

Figure 1 Flow diagram of patients

In the present study, groin hernias were classified by the EHS groin hernia classification and summarized by making a distinction between the anatomic location and the size of the hernia orifice defect in cm; in the case of combined hernia, we categorized the size of hernia according to the largest defect to not oversized the defect. Thus, a direct hernia of 2.5 cm combined with an indirect hernia of 2 cm is depicted as a mixed hernia with a size of 1.5-3 cm. We categorized recurrent hernia as a specific separated group to be easy to interpret and compare between both groups.

All patients were asked to void urine before the procedure in case of inguinoscrotal hernia and recurrence hernia foley catheter was inserted. An infra-umbilical incision was made, and ipsilateral retrorectus space was entered and created inferiorly to the preperitoneal space with round-shaped balloon expansion. The optical port was placed ipsilateral to the larger hernia size for bilateral hernia. Two 5-mm ports were inserted in the midline: the first was placed 4 cm above the pubic symphysis, and another one in between the two ports. Reduction of the hernial sac and development of a preperitoneal pocket following the critical view of the MPO concept.[10] The type of hernia was recorded according to the EHS groin hernia classification.[11] The orifice size of the hernia defect was estimated using the 5 mm closed diameter and 20 mm open diameter of the laparoscopic graspers as a guide. All of the M2 or M3 direct defects were closed by using absorbable 3-0 barbed suture (V-Loc 180 3-0 15 cm, Covidien), and pseudosac was pulled and incorporated into the closure (TEP plus technique) before the introduction of the mesh to reduce recurrence and seroma formation.[12,13] In case of a large indirect hernia that is difficult to complete sac reduction, we transected the sac and closed the proximal end with an end loop to reduce surgical trauma and operation time.[14] After adequate dissection of space then, mesh (uncut 15 × 10 cm Monofilament Macroporous Polyester mesh, Versatex) was introduced to cover the MPO with an overlap of at least 3-4 cm. The mesh fixation technique was randomized into either fixation or non-fixation groups as determined by the intraoperative opening of the envelope in order. In the fixation group, the mesh was fixed by 3 permanent tacks (Autosuture Protack, Covidien), one at Cooper's ligament, and another two tacks at area medial and lateral to epigastric vessel 2 cm above the iliopubic tract.[15] In the non-fixation group, no fixation of the mesh was done. In bilateral hernia, each side was considered separately in bilateral repairs, giving rise to three possibilities: fixation on both sides, non-fixation on both sides and fixation on one side only. In the last possibility, after the completed dissection of all zones of the inguinal area on both sides, mesh insertion and fixation were performed first on the side randomized to be the fixation group so that any mesh overlap in the midline would not create inadvertent fixation of the other side. No drain was used in all of the patients in this study. The mesh fixation technique was recorded only in the operative note.

Postoperatively, the patient was allowed to take a soft diet after the recovery from general anesthesia. Ibuprofen 400 mg q 8 hr and Acetaminophen 500 mg q 6 hr were used as analgesics for all patients, in case of moderate to severe pain morphine 3 mg was provided on demand in every 6 hr. The amount of morphine consumed and pain score based on the numeric rating scale (NRS) were recorded by nurses on the 12 hrs, 24hrs postoperative. Home medication for all patients was Ibuprofen 400 mg q 8 hr 10 tabs and Acetaminophen 500 mg prn for pain q 6 hr 10 tabs. Patients were called for follow-up at 2 days and 1 week. All patients were seen as part of routine postoperative care two weeks, 3 months, and 6 months after surgery to evaluate any complications, pain score, and recurrence. Chronic groin pain was defined as a pain score > 3 in the groin region on the operative side, persisting beyond 3 months.

Statistical analysis was performed using SPSS software version 25 by a person blinded to the method of mesh fixation. Repeated measure ANOVA models were used to assess change in NRS over time and differences within each group. Comparisons of quantitative data between groups were analyzed using an independent *t*-test, and the Chi-square or Fisher exact probability test was used for qualitative data. $P < 0.05$ was considered statistically significant.

Results

One hundred and ten hernia repairs in 101 patients were enrolled in the trial between July 2022 and August 2023. There were 9 patients who presented with a bilateral hernia, and 92 patients had a unilateral hernia. The mean operative time in unilateral hernia was 59 minutes, and 81 minutes in bilateral hernia. There were no significant differences between the two groups in baseline demographic characteristics, including age, BMI, sex, ASA

classification, EHS hernia classification, and incidence of recurrent defect (Table 1). The mean follow-up period of the present study was 12.4 ± 2.74 months. Ninety-nine percent of patients returned for clinical follow-up at a minimum of six months.

Table 1 Patient characteristics

Patient characteristics	Fixation group (n = 55)	Non-fixation group (n = 55)	*p*-value
Age (mean ± SD)	64.1 (11.9)	63.6 (13.8)	0.859
BMI (mean ± SD)	22.7 (3.0)	22.9 (3.3)	0.739
Sex (male %)	94.5%	100%	0.079
ASA classification n (%)			
ASA 1	3 (5.5)	4 (7.3)	0.646
ASA 2	37 (67.3)	40 (72.7)	
ASA 3	15 (27.2)	11 (20.0)	
EHS hernia classification n (%); Defect size			
< 1.5 cm	5 (9.1)	5 (9.1)	0.976
1.5-3 cm	35 (63.6)	36 (65.5)	
> 3 cm	15 (27.3)	14 (25.4)	
Hernia type			
Indirect (L)	42 (76.4)	41 (74.5)	0.455
Direct (M)	5 (9.1)	5 (9.1)	
Femoral (F)	2 (3.6)	0	
Mixed	6 (10.9)	9 (16.4)	
Recurrent hernia	5 (9.1)	3 (5.5)	0.463
Side of hernia; Right : Left (%)	49.1 : 50.9	60 : 40	0.251
Follow-up attendance	54 (98.2)	55 (100)	0.315

SD: standard deviation

Direct defect closure was performed in 10 (9.1%) direct hernia sizes M2 and M3 (including 7 cases of M2 hernia, 1 case of M2L1 hernia, 1 case of M3 hernia, and one case of M3L1 hernia). There were 23.6% indirect sac transactions in both groups, and almost all were performed in large indirect hernia sacs. The mean operative time was 57.6 min in the fixation group and 54.7 min in the non-fixation group. There were 2 conversions to the TAPP technique in the fixation group due to the difficulty of completing the operation by extraperitoneal approach in sliding hernia and large scrotal hernia. Peritoneal tears requiring operative closure were 7.3% in the fixation group and 21.8% in the non-fixation group; the *p*-value was 0.031, and techniques used for the closure included clipping, extracorporeal knot, and endoscopic suturing. They were similar in both groups in postoperative length of stay ($p = 0.175$), postoperative opioid use ($p = 0.791$), or time to regular activity ($p = 0.299$). There was no statistical significance in time taken to regular activity between both groups; more than 95% of cases can do light daily activity by themself within 2-3 days postoperative.

The most common complication after TEP is seroma, which occurred in 20% of the fixation group and 14.5% of the non-fixation groups. Only 3.6% of seromas needed aspiration in the fixation group and 1.8% in the non-fixation group. Other complications were minor and resolved uneventfully (Table 2).

Table 2 Variables used to compare between groups

	Fixation group (n = 55)	Non-fixation group (n = 55)	*p*-value
Op time (mean ± SD) (min)	57.6 (19.4)	54.7 (19.5)	0.431
Conversion to TAPP, n (%)	2 (3.6)	0	0.154
Peritoneal condition, n (%)			
No tear	29 (52.7)	19 (34.6)	0.035
Tear (no need to repair)	9 (16.4)	11 (20)	0.621
Closure of peritoneal tear	4 (7.3)	12 (21.8)	0.031
Transection of the hernia sac	13 (23.6)	13 (23.6)	1.000
Length of stay (mean ± SD) (day)	1.2 (0.4)	1.1 (0.3)	0.175
Post op Morphine use (mean ± SD) (mg)	1.5 (1.9)	1.4 (1.8)	0.791
Time taken to return to normal activities, n (%)			
2-3 days	51 (94.4)	54 (98.2)	0.299
4-5 days	3 (5.6)	1 (1.8)	
Complications, n (%)			
Urinary retention	3 (5.5)	1 (1.8)	0.308
Seroma	11 (20.0)	8 (14.5)	0.449
Seroma required aspiration	2 (3.6)	1 (1.8)	0.558
Testicular tenderness	0	1 (1.8)	0.315
Umbilical wound infection	0	1 (1.8)	0.315
Chronic groin pain	1 (1.9)	0	0.495
Recurrence	0	0	1.000

SD: standard deviation; TAPP: transabdominal preperitoneal approach

The ANOVA demonstrated that in each fixation technique, there was no statistical significance in pain level (p = 0.480) (Table 3). There were no statistically significant differences in mean pain scores between the fixation and non-fixation groups at each follow-up time point (Figure 2).

Table 3 Statistical results of the repeated measure ANOVA for the pain levels of patients subjected to Fixation and Non-fixation techniques

Source	SS	df	MS	F-test	*p*-value	Effect size	Observe Power
Treatment	1.510	1	1.510	0.502	0.480	0.005	0.108
Error	322.157	107	3.011				

SS: Sum of the square; df: degree of freedom; MS: Mean Square

Chronic groin pain was equal in the fixation and non-fixation groups, 1.9% and 0 %, respectively (p = 0.495). At 6 months, no recurrence of hernia was observed.

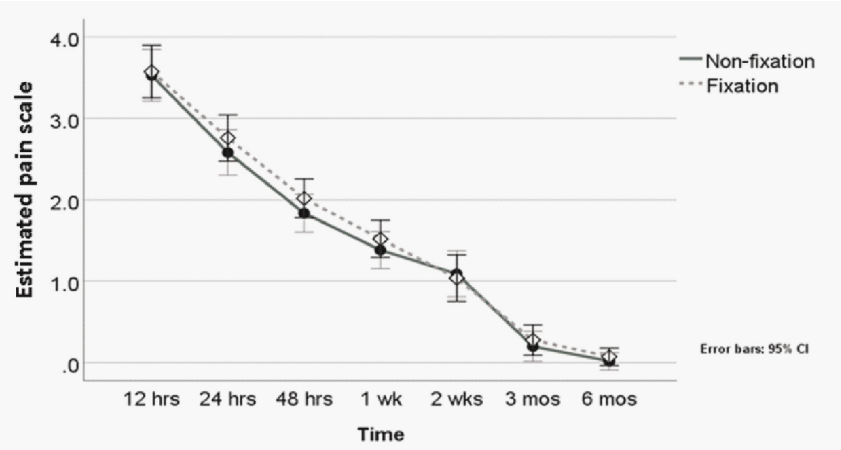

Figure 2 Pain level at each time point for fixation (diamond) and non-fixation (circle) groups

Pain level mean (± SD)	12 hrs	24 hrs	48 hrs	1 wks	2 wks	3 mos	6 mos
Fixation group	3.6 (1.3)	2.8 (1.1)	2.0 (0.9)	1.5 (0.8)	1.0 (1.1)	0.3 (0.7)	0.1 (0.5)
Non-fixation group	3.5 (1.1)	2.6 (0.9)	1.8 (0.9)	1.4 (0.8)	1.1 (1.1)	0.2 (0.6)	0 (0.1)

SD: standard deviation

Discussion

Stabilization of the mesh, even in the absence of any fixation, was explained by two mechanisms. Early stabilization is achieved by the "sandwich effect," the pressure between the peritoneal layer and the abdominal wall, which is enhanced by adequate dissection for adequate space for placing mesh. In the later period, the mesh is held in place by tissue incorporation into the mesh within 2-3 weeks and collagen deposition by 2 months.[16,17] Any recurrence because of non-fixation of the mesh would be expected to be an early phenomenon,[18,19] making the 6-month length of follow-up sufficient to evaluate recurrence for the purposes of the present study.

Even the systematic review and meta-analyses[20-22] revealed no significant differences in the rates of recurrence or postoperative pain between permanent tack fixation and non-fixation in TEP, but most of the studies contain only limited information on hernia-defect size[8], and a majority of hernia defects were small in some studies,[9] given this the EHS classification was used, and the present study had included more than 90% of cases which defect size was larger than 1.5 cm and the size of defect > 3 cm more than 25% of cases and also included recurrent hernia to strengthen the level 1 evidence, especially for the larger size of the hernia.

The results of the present study have shown statistical similarities in both fixation techniques in terms of chronic groin pain, recurrence rate, operation time, conversion rate, postoperative pain, postoperative opioid requirement, postoperative complications, length of hospital stay, and time to return to regular activity. Even numerous studies have reported a statistically significant increase in pain levels and chronic groin pain related to tack fixation,[18,19] however, some of them showed significantly higher in the fixation group only for mild pain. The difference between the groups was not statistically significant for moderate and severe pain, which means the clinical significance is doubtful. In addition, the incidence of chronic pain increases proportionately with the number of tacks used, with statistically significant at the cutoff point of six tacks.[9] The fixation technique in the present study used only 3 tacks in a safe area to avoid nerve injury (at Cooper's ligament, area medial and lateral to epigastric vessel 2 cm above the iliopubic tract)[15] that is the plausible explanation for why our result in the present study showed no significant difference in pain level and chronic groin pain between the two groups.

The main concerns for non-fixation are mesh migration and hernia recurrence. Mesh stabilization with non-fixation occurred intrinsically due to the mesh's preperitoneal location in TEP; Choy et al. demonstrated this phenomenon's effectiveness. They showed that an unfixed mesh could not be induced to move by on-table cycles of hip flexion (confirmed on inspection of the mesh

by re-laparoscopy of the preperitoneal space).[23] More than 5,300 TEP repairs with non-fixation techniques have now been reported. The mean recurrence rate in these series is less than 1% after two years, equal to the recurrence rate of standard repairs with mesh fixation.[6,8,24-27] However, Many studies have demonstrated a higher recurrence rate associated with the presence of direct and large defects.[28] IEHS (International Endohernia Society) guideline 2018 suggested that in almost all cases of inguinal hernia, any type of mesh fixation in TEP repair is unnecessary, except in sizeable direct defect hernias (M3- EHS classification) mesh fixation is recommended. Due to the present study including M3 direct hernia in the study group, our protocol was set to close all direct defects larger than M1 to reduce the recurrence according to the systematic review and meta-analysis,[12,29-30] which suggested that closure of the medial hernia defect in laparoscopic inguinal hernioplasty minimizes the risk of recurrence without an increase in postoperative pain or complications. The present study showed no statistically significant difference in recurrence rates at six months in both groups and no case of recurrence after TEP repair in this study. There were 10 (9.1%) cases of M2 or M3 direct defect, with 5 cases in each group, which are statistically similar (p = 1.000). Even though all 5 cases of direct defect closure in the non-fixation group had no recurrence after 6 months of follow-up, we cannot make any summary due to the study population being too small; further study trials are needed for further evaluation. However, instead of fixation techniques, the critical factors for successful long-term mesh stabilization are adequate preperitoneal dissection, exposing all the peritoneal weak points, and using adequately large pieces of mesh.

Based on this result, a non-fixation approach may be adopted routinely and safely in all elective laparoscopic TEP hernia repair; however, the TEP plus technique has to be performed in all direct defects larger than 1.5 cm.[12] On the contrary, tack Fixation of the mesh (by the techniques described earlier in the part of the surgical technique) even seems no more beneficial in most cases. Still, it can be performed in selected cases where the hernia defect is quite large, and there is a tendency of mesh migration due to there being no increase in pain level, chronic groin pain, and complications.

It was statistically significant in peritoneal tears requiring operative closure, with 7.3% in the fixation group and 21.8% in the non-fixation group, p = 0.031. We can't explain this result. However, some studies showed that peritoneal injury has more frequently occurred in right-sided hernia,[31] and 60% of cases in the non-fixation group had hernia on the right side compared to the fixation group, 49.1% on the right side. Other independent risk factors for peritoneal tear were indirect hernia type and previous hernia surgery[32] which did not support our result due to no difference in these risks in both groups. The present study's overall incidence of peritoneal tear was 32.8% compared to 19.7 - 47% from the previous studies.[31-34] To manage peritoneal defects, we use 5 mm endoclip for minor defects, pre-tied suture loop ligation for medium defects, and intracorporeal suturing for large defects.

Even though there was no cost analysis in the current study, it is obvious that the titanium spiral tack applicator is costly, and RCT studies confirmed that there was a statistically higher total cost in the tack fixation group.[6,8,35]

Conclusion

There was no statistical significance in chronic groin pain and recurrence between fixation and non-fixation groups. The non-fixation approach should be adopted routinely and safely in laparoscopic TEP hernia repair. Even the tack fixation technique applied in this study was not associated with the risk of significant pain level and chronic groin pain; however, it is associated with high operative cost, so it should be used only in very selected situations in TEP.

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Original Article

Clinical Outcomes Following Surgical Revascularization for Acute Lower Limb Ischemia

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Abstract

Objectives: To assess the clinical outcomes of surgical revascularization in patients diagnosed with acute lower limb ischemia (ALI). The primary outcome was defined as the limb salvage rate within 30 days after surgery.

Methods: This is a retrospective single-center study. The target population was recruited from the Prapokklao Hospital database between January 2019 – December 2023. Patients who were diagnosed with acute occlusion of the artery according to the International Classification of Disease 10th Revision (ICD-10) code I74.0, I74.3, and I74.5 were identified. Medical records were analyzed for demography, clinical presentation, etiology, Rutherford severity classification, revascularization procedures, major amputation, mortality within 30 days after revascularization, and data during follow-up.

Results: This study enrolled a total of 70 patients, 46 men (65.71%) and 77 affected limbs. The mean age was 65.67 years (SD 13.69 years), and the median was 65 years, ranging from 19 to 94 years. Co-morbidities: 42 (60%) hypertension, 28 (40%) peripheral arterial disease, 26 (37.14%) atrial fibrillation. Etiologies: 36 (51.43%) thrombosis (34.29% in-situ thrombosis of the native vessel) and 34 (48.57%) embolism. Rutherford classification of severity categories I, IIa, and IIb was 1 (1.42%), 21 (30.0%), and 48 (68.58%), respectively. The modalities of revascularization included 70 (100 %) thromboembolectomy with a Fogarty catheter, 30 (42.86%) intra-arterial angioplasty with balloon or stent, 8 (11.43%) bypass procedure, 6 (8.57%) endarterectomy and 8 (11.42%) fasciotomy. Technical success was 98.57 %. The mean operative time was 195.07 minutes (SD 95.51 minutes). The median hospital stay was 8 days. Post-operative complications were 8 (11.43%) bleeding, 7 (10%) compartment syndrome, 5 (7.14%) reperfusion injury, 5 (7.14%) acute kidney injury, 2 (2.86%) pneumonia and 1 (1.43%) acute myocardial infarction. The 30-day major amputation rate and mortality were 10.0% and 5.71%, respectively. At 30 days, sixty-three patients (90%) had limb salvage, and Four (5.71%) patients had died.

Conclusion: Clinical outcomes following surgical revascularization for acute lower limb ischemia in our hospital showed high technical success and limb salvage rates. The limb salvage rate was 90.0%, and the mortality rate was 5.71%.

Keywords: Acute lower limb ischemia (ALI), Embolism, Thrombosis, Revascularization, Limb salvage

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Introduction

Acute lower limb ischemia (ALI) is defined as a sudden decrease in limb perfusion, causing a potential threat to limb viability. Presentation less than 2 weeks (14 days) following the acute event.[1] Acute arterial occlusion is caused by embolism and thrombosis. Embolism results from material passing through the arterial tree and obstructing a peripheral artery. The common embolism originates from the heart (atrial fibrillation, myocardial infarction, valvular disease), and another source is arterial pathology (atherosclerosis, aneurysm). Thrombosis results from blood clotting within an artery and usually occurs at the point of atherosclerotic vessels, bypass graft, and in the stent.[2] The other cause of acute thrombosis can occur in the state of hypercoagulability (malignancy), low arterial flow (congestive heart failure, shock, arterial dissection), and hyperviscosity (polycythemia vera, dehydration).[3]

Once arterial blood flow is obstructed, it results in ischemia of the leg tissues, including nerves, skeletal muscles, and skin. The classic clinical symptoms of ischemic limbs are characterized by abrupt onset of progressive pain in the affected limb, pulselessness, poikilothermia, pallor, paresthesia, and paralysis. The Rutherford classification defines the extent of ischemia based on clinical findings (sensory loss and muscle weakness) and Doppler measurements (arterial and venous signal) divided into three classes: class I-viable, class IIa-marginally threatened, class IIb-immediate threatened, and class III-irreversible.[4] In class III, there is no indication to improve the blood supply; major amputation and conservative care are appropriate treatments. Patients with class I, IIa, and IIb required immediate revascularization to remove obstructing clots and treat underlying pathology.

ALI is a limb- and life-threatening condition and requires urgent revascularization. The selection of revascularization modalities depends on the severity of limb ischemia, occlusion level, and ALI's etiology. Revascularization approaches include surgical approach (thromboembolectomy, surgical bypass), endovascular intervention (thrombolysis, trans-arterial angioplasty), and combined surgical and endovascular technique (hybrid therapy).[5]

This study aimed to assess the outcomes of surgical revascularization in ALI patients. The primary outcome was defined as the limb salvage rate within 30 days after surgery.

Materials and Methods

Patients

This is a retrospective analysis of 70 patients (77 affected legs) with ALI who were treated in Prapokklao Hospital, Chanthaburi. The target population was recruited from the hospital database between January 2019 - December 2023. Patients who were diagnosed according to the International Classification of Disease 10th Revision (ICD-10) code I74.0 (occlusion of the aorta and iliac arteries), I74.3 (occlusion of the femoral and popliteal artery) and I74.5 (occlusion below the knee) were identified. The study protocol was approved by the ethics committee. All patients presented with acute lower limb ischemia within 2 weeks. Rutherford class I, IIa, and IIb were treated with surgical revascularization (Thrombo-embolectomy with Fogarty catheter, trans-arterial angioplasty with balloon/stent, and surgical bypass). Rutherford category III (irreversible limb ischemia) was excluded. All medical record data included demography, etiology (thrombosis or embolism), the severity of ALI, level of arterial occlusion, revascularized procedures underwent, 30-day outcomes (major amputation, mortality), follow-up data (major amputation, mortality, recurrent ALI, and walking status (return to normal, walking with a prosthesis, bedridden).

Preoperative protocol

Once the clinical diagnosis of ALI was confirmed, our protocol included immediate infusion of intravenous unfractionated heparin (UFH) to limit clot formation and prevent thrombus propagation and worsening ischemia. We start UFH at a loading dose of 80 units/kg, followed by infusion at 18 units/kg/hr, and adjusted to achieve therapeutic activated partial thromboplastin time (aPTT) every 6 hours (keep aPTT ratio of 2-3 times the control value). UHF infusion continued throughout the operation and postoperative period. Ancillary support measures included intravenous fluid infusion, oxygenation, and pain management. Preoperative imaging with duplex ultrasound and computed tomography angiography (CTA) is performed for treatment planning in complex cases, such as ALI in peripheral arterial disease, AAA, and previous vascular intervention (bypass surgery, trans-arterial angioplasty). All imaging performed without delay a definitive revascularized procedure. Revascularized procedure is immediately planned and performed as soon as possible after adequate patient preparation.

Limb salvage procedure

All procedures were done under general anesthesia. Both the groin and the entire legs were prepared and draped. All of our patients were approached through common femoral artery (CFA) bifurcation. Occasionally, popliteal artery or below-the-knee artery exposure may be required. Proximal and distal control of the vessel was ensured before arteriotomy. Fogarty catheter is first used for clot removal for both emboli and thrombosis cases until good blood flow is present. Endarterectomy with closure at CFA was performed in some cases. After the arteriotomy site closed, a completion angiogram was performed. The thrombo-embolectomy procedure was repeated if a residual clot was detected. Intra-arterial angioplasty with balloon and stent was applied after removing the clot for treated concomitant atherosclerotic lesion or focal dissection that interferes with the distal blood flow. Bypass procedure may be performed as a primary option or as a second-line treatment when thrombo-embolectomy or intra-arterial angioplasty fails. Fasciotomy is considered in patients with compartment syndrome. Technical success was defined as restoring blood flow to the lower limb, as confirmed by an intraoperative angiogram, Doppler ultrasound, and pulsation of pedal arteries. All patients were transferred to the intensive care unit.

Postoperative outcomes

Early period, 30-day outcomes measurement, including morbidities, mortality, and major amputation. Follow-up evaluation, including mortality, major amputation, and walking status.

Statistical analysis

Categorical variables were presented as counts and percentages, and continuous variables were presented as mean ± standard deviation (SD). Categorical variables were compared using the Chi-square test. Continuous variables were compared using the unpaired *t*-test. A p-value less than 0.05 is considered statistically significant. All static analysis was performed using Microsoft Excel®.

Results

Patient characteristic

A total of 70 patients. There were 46 male (65.72%) and 77 affected limbs. The mean age was 65.67 years (SD 13.69 years). 42 patients (60%) were active smokers. Overall comorbidities including 60% hypertension, 40% peripheral arterial disease (PAD), 37.14% atrial fibrillation (AF), 28.6% dyslipidemia, 26% diabetes, 5.71% abdominal aortic aneurysm (AAA), 4.23% polycythemia vera, and 2.85% malignancy (Table 1).

Table 1 Patient demography, relevant risk factors, and comorbidities

	N (total 70)	Percent (%)
Gender		
Male	46	65.71
Female	24	34.29
Age (years)		
Range	19 - 94	
Mean	65.67 ± 13.69	
Median	65.0	
Comorbidity		
Hypertension	42	60
Peripheral arterial disease	28	40
Atrial fibrillation	26	37.14
Dyslipidemia	20	28.57
Diabetic mellitus	18	25.71
Coronary artery disease	9	12.86
Cerebrovascular disease	4	5.71
Abdominal aortic aneurysm	4	5.71
Polycythemia vera	3	4.22
Cancer	2	2.85

Etiologies

Thrombosis was 36/70 (51.43%), and embolism was 34/70 (48.57%). For thrombosis, 34.29% was developed in the native artery, 10.0% was bypass graft thrombosis, and 7.14% was in-stent thrombosis). Embolism was 34/70 (48.57%), and 51.43% of emboli had AF (Table 2).

Severity and level of occlusion

Rutherford classification; class I = 1.43%, IIa = 30% and IIb = 68.57%. The median duration of symptoms before presentation was 2 days.

Level of occlusion: Aorta and iliac levels were 8 patients (11.42%), 11.27% iliac, and 85.92% femoral and popliteal artery. 1.41% below the knee level (Table 2).

Table 2 Etiology, location of occlusion, and severity

	N (total 70)	Percent (%)
Etiology		
Thrombosis	36	51.43
Native artery	24	34.29
Bypass graft	7	10.0
Stent	5	7.14
Embolism	34	48.57
Location of occlusion		
Aorta and iliac	8	11.42
Femoral and popliteal	61	85.92
Below the knee	1	1.42
Rutherford classification		
Category I	1	1.42
Category IIa	21	30.0
Category IIb	48	68.58

Modalities of revascularization

70 (100%) embolectomy, adjunctive procedure with 42.86% intra-arterial balloon and 22.86% stent for correct intimal dissection and atherosclerotic lesion. 11.43% surgical bypass. Technical success was 69/70 (98.57%). The median operative time was 170 minutes. All of the patients were treated by thrombo-embolectomy for blood clot removal. Other adjunctive procedures performed included intra-arterial angioplasty included 42.86% balloon angioplasty, 22.86% stent, 8.57% bypass surgery (1 axillo-femoral, 2 femoral-femoral, 2 femoral-popliteal, and 1 popliteal-posterior tibial bypass), 10% endarterectomy, and 11.43% fasciotomy. The mean operative time was 195.07 ± 95.91 minutes; the median operative was 170 minutes. In the thrombosis group, balloon angioplasty 21/36(58.33%), stent 14(38.89%), Bypass 8 (24.22%), endarterectomy 4 (11.11%). Operative time 226.94 ± 97.97 minutes, median 227.5 minutes. In the embolic group, balloon 9/34 (26.47%), stent 2 (5.88%), bypass 0, endarterectomy 3(8.82). Operative time was 160.30 ± 81.62 minutes, and the median was 150 minutes (Table 3).

Table 3 Revascularization modalities of patients with acute thrombosis and embolism

	Thrombosis (N = 36)	Embolism (N = 34)	*P* value
Revascularization (%)			
Thrombo-embolectomy	36 (100)	34 (100)	-
Balloon	21 (58.33)	9 (26.47)	0.007
Stent	14 (38.89)	2 (5.88)	0.001
Bypass	8 (24.22)	0 (0)	0.010
Endarterectomy	4 (11.11)	3 (8.82)	0.749
Operative time (min)	226.94 ± 97.97	160.3 ± 81.62	0.003
Technical success (%)	35 (97.2)	34 (100)	-

Postoperative results

Outcome data included 30-day or in-hospital mortality, major amputation, postoperative complications, and other adverse events. The mortality rate was 5.71% (4 cases included 2 strokes, 1 pneumonia, and 1 superior mesenteric ischemia). Major amputation was performed in 7 patients (10.0%). Complications after revascularization included 11.43% bleeding at the surgical site and fasciotomy wound, 10% compartment syndrome, 7.14% reperfusion injury, and 7.14% acute kidney injury (Table 4).

Table 4 Postoperative outcomes and discharge status

	N (total 70)	Percent (%)
Complications		
Bleeding	8	11.43
Compartment syndrome	7	10.0
Reperfusion injury	5	7.14
Acute kidney injury	5	7.14
Acute myocardial infarction	1	1.43
Discharge status		
Minor amputation	5	7.14
Major amputation	7	10.0
Limb salvage	63	90.0
Mortality	4	5.71

Follow up period

The mean follow-up period was 13.5 months (range 1-52 months). Walking status at home within 30 days included, return to normal status was 46 patients (65.71%), prosthesis used was 7 patients (10.00%), bedridden was 9 patients (12.86%), and unknown status was 8 patients (11.43%). Recurrent ALI occurs in 12 patients (17.14%) (11 thrombosis and 1 embolism). Nine patients (75%) were men with a mean age of 60.25 ± 13.12 years; the median age was 59 years. Of them, the active smoker was 9 patients (75%), common comorbidities included, PAD was 10 patients (83.33%), hypertension was 8 patients (66.67%), AF was 4 patients (33.33%), diabetes was 3 patients (25%), and AAA was 2 patients (16.67%). The major amputation rate was 8.57%. Mortality occurs in 4 patients (5.57%) (Table 5).

Table 5 Data during the follow-up period

	N (total 66)	Percent (%)
Walking status (within 30 days)		
Return to normal	46	69.70
Walking with prosthesis	7	10.60
Bedridden	9	13.64
Unknown	4	6.06
Recurrence ALI	12	18.18
Native artery	6	50.0
Bypass graft	4	33.33
In-stent	2	16.67
Major amputation	6	9.10
Mortality	4	6.06

Discussion

In this study, ALI affected older patients and was more prevalent in men than in women. Medical comorbidities and atherosclerotic risk factors include hypertension, PAD, AF, hyperlipidemia, diabetes, and active smoking. Our data is similar to those of other Asian and Western countries. In Thailand, Mutirangura P et al. report that ALI in the Thai population's mean age was 62 years, equally prevalent among men and women.[6] In Japan, Umetsu et al. report the demography of ALI patients; the median patient age was 72 years, with no sex differentiation.[7] Swedish study reported that the median patient age was 74, and 49% were women.[8] In the United States, Baril et al. report 20 years of experience in ALI treatment; the mean age was 80.6 years, and 60% were female.[9] Common comorbidities in all studies included hypertension, dyslipidemia, AF, PAD, and other atherosclerotic risk factors. Most patients are still actively smoking.

Thrombosis and embolism were the significant causes of ALI. The clinical presentation and outcomes of treatment between both groups were different. In our study, Thrombosis vs embolism was 51.43% vs 48.57%. In the thrombosis group, PAD is more common than embolism (61.11% vs 20.59%, $p < 0.001$, 95% CI 7.93 - 12.41). In the embolic group, AF is more related to thrombosis (52.94% vs 22.22%, $p < 0.001$, 95% CI 3.84-6.41). The severity of clinical presentation (Rutherford classification) was no different. Mutirangura P et al. concluded that peripheral pulse on the contralateral limb was more commonly found in patients with acute arterial embolism than in patients with acute arterial thrombosis (71.4% vs. 31.0%, $p < 0.001$). AF was detected more in patients with acute embolism than thrombosis (31.9% vs. 3.4%, $p = 0.004$).[10]

Currently, surgical treatment for ALI includes open surgery and endovascular and hybrid techniques. Thrombo-embolectomy using a Fogarty catheter is effective for removing blood clots; most surgeons are familiar with this technique.[11] However, open thrombo-embolectomy cannot wholly remove the thromboembolism. Up to 30% demonstrated residual thrombus on completion of angiogram after thrombo-embolectomy.[12] Residual thrombus associated with recurrent occlusion, re-intervention, and limb loss. The completion of angiography after thrombo-embolectomy is recommended. If residual thrombus was found, further thrombo-embolectomy or bypass may be considered.[5] Intra-arterial thrombolysis (catheter-directed thrombolysis) using recombinant tissue plasminogen activator (rtPA) or urokinase is considered an alternative to surgery.[13]

Modalities of revascularization in our institute included open surgery, endovascular, and hybrid techniques. All of our patients were treated by thrombo-embolectomy with a Fogarty catheter; no thrombolysis was used. In the thrombosis group need, more adjunct procedures were performed. Intra-arterial angioplasty with a balloon in thrombosis vs. embolism was 58.33% vs. 26.47%, $p = 0.007$. The stent used in thrombolysis vs. embolism

was 38.89% vs. 5.88%, $p = 0.001$. The operative time in the thrombosis group was significantly longer than in the embolic group ($p = 0.003$). In embolism, treatment may be resolved with embolectomy alone without other adjunct procedures because the arterial lumen is more normal than thrombosis. Some embolic cases needed trans-arterial intervention to treat atherosclerosis or focal intimal tear after embolectomy. Our data show that 26% of the embolic group was treated by intra-arterial angioplasty. Berczi V et al. treated seven acute thrombotic occlusions in iliac arteries by stent implantation to correct the atherosclerotic lesions. Technical success was 100%, no distal embolization.[14] Kim C et al. report the outcomes of stent-assisted recanalization in ALI. The common site of stent used was iliac arteries, which was 100% technical success. The mean follow-up period was 14.4 months, with no re-occlusion or restenosis.[15]

In this study, the bypass procedure was performed in 8 patients (11.42%). Bypass surgery in thrombosis vs embolism was 24.22% vs 0%, $p < 0.001$). Indications for bypass surgery include thrombosed iliac artery, thrombosed popliteal artery aneurysm, in-stent, or bypass graft occlusion. Bypass surgery may be the primary or secondary intervention after ALI. This procedure is indicated for patients with acute-on-chronic occlusion after endovascular or thrombo-embolectomy failure.[14] Patients who underwent bypass surgery were more likely to had previous endovascular intervention or bypass surgery for other conditions. Baril et al. reported the outcome of bypass surgery in ALI. Infrainguinal bypass was performed for 323 patients, and 40.6% of patients used a prosthetic conduit. Statistically significant factors for bypass with ALI included longer operative time ($p = 0.007$), greater blood loss ($p < 0.0001$), and increased rate of in-hospital major cardiovascular events ($p < 0.0005$).[9]

All of the major amputation in our study was performed in patients who developed progressive muscle gangrene or reperfusion injury after successful revascularization. Major amputation within 30 days occurred in 10% of patients, and the limb salvage rate was 90%. The mortality rate was 5.71%. Hemingway et al. reported that the major amputation rate in ALI Rutherford I and II was 9%, and mortality was 5%.[16] Overall outcomes after ALI treatment were a high rate of limb loss (12-50%) and mortality (20-40%).[17-19]

The mean follow-up time in our study was 13.5 months (range 1-52 months). Over 69% of patients return to normal walking status. Recurrent ALI occurred in 12 patients (18.18%), the limb salvage rate was 91.0%, and the mortality rate was 6.06%. In this present study, the most common cause of recurrence was thrombosis. The related factors of recurrent occlusion included active smoking, PAD, and hypertension. Vakhitov D et al. reported that the occluded bypass graft and impaired tibial runoff were significantly associated with the development of occlusion.[20]

Patients with ALI are prone to repeated major cardiovascular events, often leading to readmission, re-intervention, and mortality. In patients with symptomatic PAD, ALI is most often caused by thrombosis of the diseased native vessel, bypass graft, or stent. Following revascularization for ALI, regular follow-up may be beneficial, including clinical evaluation and assessment of functional status.[5,21]

The study's limitations include the retrospective, single-center design with a small sample size and the missing or inaccurate data obtained from chart review.

Conclusion

In our present study, ALI affected older patients and was more prevalent in men than in women. Over sixty percent of patients had medical comorbidities and atherosclerotic risk factors (hypertension, dyslipidemia, AF, PAD, and active smoking.). Etiology equally in thrombosis and embolism. In the thrombosis group, PAD is more common than embolism and requires more adjunctive procedures (intra-arterial angioplasty or bypass procedure). In the embolic group, AF is more related than thrombosis. Clinical outcome after revascularization for viable limb ALI revealed the 30-day limb salvage rate was 90.0%, and the mortality rate was 5.71%.

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Original Article

Decoding Factors Influencing Post-Operative Outcomes in Surgical Residents' Minor Surgeries

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Abstract

Objective: Effective surgical residency training is essential for developing competent surgeons. The first year of training focuses on basic knowledge and fundamental surgical skills. Consequently, minor surgical procedures suit first-year surgical residents with minimal complexity and low complication rates. This pilot study aimed to evaluate the complications associated with surgical residency practice and examine the factors associated with these complications.

Materials and Methods: This study employed a single-center retrospective review method to evaluate the complications arising from surgical residents' minor operations and identify the factors associated with these complications. Data were collected at Siriraj Hospital over three consecutive years, from 2016 to 2018.

Results: During the study period, a total of 1,572 minor operations were performed by surgical residents. The overall complication rate was 4.3%, which included surgical site infections, wound dehiscence, hematoma or bleeding, seroma, and superficial skin necrosis. Among the surgical site infection cases, an operative time exceeding 30 minutes (OR 13.3, ***p***-value = 0.00) and lesion size larger than two centimeters (OR 5.24, ***p***-value = 0.01) were significant influencing factors for complications. Conversely, residents' background characteristics and the presence of a 'July effect' did not significantly impact surgical outcomes.

Conclusion: The rate of complications associated with minor operations performed by residents at Siriraj Hospital was comparable to the findings from other studies. The most common complications were wound dehiscence and surgical site infections. Operative time and lesion size were significant factors affecting complications. The results of this study can contribute to enhancing surgical residency training.

Keywords: Minor surgery, Complication, Surgical resident, Training

Introduction

Siriraj Hospital is one of Thailand's largest tertiary hospitals and medical training centers. Our mission includes providing medical services and promoting the well-being of Thais. Moreover, our responsibility extends to the development of qualified physicians. Striking a balance between providing standard patient care and delivering a high-quality training program is always a significant concern. An effective surgical residency program is key for developing qualified surgeons.

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Beginning from the first academic year, residents gain essential knowledge and develop fundamental surgical skills to enhance their proficiency. Minor surgical procedures are particularly well-suited for first-year surgical residents due to their lower complexity, limited time requirements, and minimal complication rates. These factors contribute to increasing residents' autonomy in performing operations.[1]

On average, complications associated with minor procedures have been reported at a rate ranging from 3% - 6%. While there have been no reports of mortality complications, it is still essential to consider the potential impact of any complications on patients' quality of life. Common complications include surgical site infections, wound dehiscence, and bleeding.[1,2] Several significant factors influence these complications, such as operative time, lesion size, and location.[2,3] Additionally, resident-related factors can affect surgical outcomes. For instance, previous studies have demonstrated that differences in the training year or level of institutional training can impact surgical outcomes.[4-7] Interestingly, a 'July effect' has even been suggested as a potential cause of complications. Indeed, a systematic review of studies published between 1989 and 2010 revealed that the mortality rate during this period was higher than during the rest of the year.[8] However, a multi-institutional study of plastic surgeries published in 2018 provided assurance that there was no statistical difference in complications based on the time of year.[9]

Ensuring patient safety is the most crucial consideration when determining the suitability of surgical procedures for first-year residents. Procedures involving larger lesions or those with potential complications present elevated risks for less experienced residents. Consequently, meticulous oversight and selective assignment of cases based on complexity are essential measures to maintain patient safety while facilitating residents' learning experiences in the operating room.

Our study aimed to evaluate the complications that arise during surgical residency practice and the factors associated with these complications. This research's practical benefit would be minimizing complications by addressing the related factors. Further, the results will serve as a guide for enhancing the surgical residency training curriculum at Siriraj Hospital.

Materials and Methods

Ethical consideration

This retrospective study was approved by the Institutional Review Board (SiRB) of Siriraj Hospital under protocol number 038/2564. The study encompassed 1,572 minor surgical operations conducted at the minor surgery clinic, Department of Surgery, Siriraj Hospital, Mahidol University, from July 1st, 2016, to June 30th, 2018.

Clinical setting

First-year surgical and third-year plastic surgery residents manage the minor surgery clinic during their general surgery rotation. A supervisor is present to oversee complicated cases and ensure patient safety. Although there are no dedicated workshops or practice sessions specifically for the residents in the clinic, the medical school curriculum includes these training opportunities. It is also assumed that residents have gained sufficient practice and experience during their internships.

Common procedures performed at this clinic include the excision of soft tissue masses, incision and drainage, debridement, cauterization, and nail extraction.

When patients visit the clinic, their care begins with measuring their vital signs. Subsequently, the resident conducts the patient history-taking and physical examination and discusses procedural planning with the attending staff. Patients might be requested to undergo further investigations, such as radiography, if necessary. Generally, all infectious cases undergo the operation during the same visit. However, procedures for soft tissue masses may be postponed or re-preparated to optimize the outcomes and minimize complications.

Most procedures are performed by the resident alone, and they are responsible for all the treatment steps, including providing information to the patient and obtaining consent, patient positioning, anesthesia administration, performing the procedure, providing wound care instructions or specific management guidance, and scheduling the next visit. Attending staff are readily available for emergencies, especially when the resident encounters critical situations and needs assistance.

Data collection

The patient's demographic data encompassed age, gender, body mass index (BMI), and underlying diseases. Operative data consisted of pre- and post-operative diagnoses, details of the procedure, lesion size and location, pre-operative skin preparation, anesthesia drug amounts, cauterization, wound dressing, operative time, estimated blood loss, and post-operative antibiotic use (if required). The post-operative section covered dressing frequency, follow-up time, duration of follow-up, complications, and the management of complications.

The complications considered in this study included surgical site infections, bleeding and hematomas, seromas, wound dehiscence, and superficial skin infections. Resident-related factors included the graduation institution, pre-training experience, academic year, division of residency program, and the operative period within the academic year.

Statistical analysis

In this study, descriptive statistical analysis was conducted using IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY, USA). Patient demographic data, operation characteristics, and postoperative complications are presented as frequencies and percentages. Factors affecting postoperative complications were assessed using a paired *t*-test and are presented herein as the mean and standard deviation (SD), with statistical significance defined as a *p*-value less than 0.05. For the subgroup analysis assessing factors influencing post-operative complications, we conducted Chi-square tests and calculated odds ratios to evaluate the relationships.

Results

During the inclusion period, 1,572 minor operations were performed at the minor surgery clinic. The patients' demographic data are presented in Table 1. Their ages ranged from 1 to 97, with a mean age of 50.3 ± 19.6 years old (IQR [35–65]). The average BMI was 24.2 ± 4.6. Common comorbidities among these patients included hypertension and diabetes mellitus. The duration of follow-up averaged 11.3 ± 11.6 days, with an average of 2.1 ± 2.8 visits.

Table 1 Demographic data

Age (years)	50.3 ± 19.6
Sex	
Male	695 (44.2)
Female	877 (55.8)
BMI (kg/m^2)	24.2 ± 4.6
Underlying disease	
Hypertension	471 (30.0)
DM	231 (14.7)
Heart disease	74 (4.7)
Renal disease	51 (3.2)
Peripheral arterial disease	13 (0.8)
Lymphatic disease	12 (0.8)
Duration of follow-up (days)	11.3 ± 11.6
Follow-up (visits)	2.1 ± 2.8

Data presented as the mean ± S.D., number (%)

Common diagnoses in this clinic included benign masses, sebaceous cysts, and abscesses, which accounted for 21.5%, 15.2%, and 10.6% of all cases, respectively. Sebaceous cysts were the most frequently diagnosed conditions dealt with by first-year residents, constituting 18.6% of their 985 procedures. In contrast, benign masses were the most common diagnosis in the third-year group, accounting for 42.9% of their 587 procedures. Regarding the types of operations performed, excisions accounted for 61.5%, incision and drainage for 16.2%, and nail extractions for 7.4%, as shown in Table 2.

Table 2 Diagnosis

	Resident year 1 Cases (%)	Resident year 3 Cases (%)	All Cases (%)
Total	**985 (62.7)**	**587 (37.3)**	**1,572**
Diagnosis			
Sebaceous cyst	183 (18.6)	56 (9.6)	239 (15.2)
Abscess	141 (14.3)	26 (4.4)	167 (10.6)
Infected sebaceous cyst	120 (12.2)	18 (3.1)	138 (8.8)
Paronychia/ ingrowing nail	111 (11.3)	7 (1.2)	118 (7.5)
Lipoma	104 (10.6)	31 (5.3)	135 (8.6)
Benign mass	87 (8.8)	252 (42.9)	339 (21.5)
Corns & callus	85 (8.6)	3 (0.5)	88 (5.6)
Skin tag	52 (5.3)	32 (5.6)	84 (5.3)
Wart	34 (3.5)	13 (2.2)	47 (3.0)
Delayed suture wound	26 (2.6)	11 (1.2)	37 (2.4)
Infected wound	20 (2.0)	11 (1.2)	31 (2.0)
Lymphadenopathy	10 (1.0)	3 (0.5)	13 (0.8)
Ganglion cyst	5 (0.5)	7 (1.2)	12 (0.8)
Keloid	3 (0.3)	53 (9.1)	56 (3.6)
Malignancy	2 (0.2)	62 (10.6)	64 (4.1)
Other	2 (0.2)	2 (0.3)	4 (0.2)
Operation			
Excision	557 (56.55)	410 (69.85)	967 (61.5)
Incision	9 (0.91)	92 (15.67)	101 (6.4)
I&D	217 (22.03)	37 (6.30)	254 (16.2)
Debridement	16 (1.62)	7 (1.19)	23 (1.5)
Suture wound	36 (3.65)	15 (2.56)	51 (3.2)
Cauterization	39 (3.96)	20 (3.41)	59 (3.8)
Nail extraction	111 (11.27)	6 (1.02)	117 (7.4)

Data presented as number (%)

During the inclusion period, a total of 68 complications were recorded in the clinic, accounting for 4.3% of the total operations. These complications included wound dehiscence (1.7%), surgical site infection (1.5%), hematoma or bleeding (0.3%), and superficial skin necrosis (0.3%). Factors related to the complications were categorized by diagnosis, operation type, and location, as shown in Table 3.

Regarding the diagnoses, sebaceous cysts appeared to be the most significant risk factor for the complications, with six cases associated with infection and five cases related to wound dehiscence. In terms of the operation type, excisions were the most critical risk factor, with 20 operations linked to wound dehiscence, 16 to infection, and 5 to wound hematoma or bleeding. As for the location, the face and posterior chest wall were the primary factors contributing to infections.

Table 3 Complications

	Complications								
	Total	Infection	Hematoma/ Bleeding	Seroma	Dehiscence	Superficial necrosis	Other	More than one	*p*-value
Total (% of total operations)	68 (4.3)	23 (1.5)	5 (0.3)	2 (0.1)	26 (1.7)	5 (0.3)	6 (0.4)	1 (0.1)	
Diagnosis (% of each diagnosis)									
Sebaceous cyst	14 (5.85)	6 (2.51)	1 (0.42)	1 (0.42)	5 (2.10)	-	1 (0.42)	-	0.00
Abscess	2 (1.20)	2 (1.20)	-	-	-	-	-	-	
Infected sebaceous cyst	6 (4.35)	3 (2.17)	1 (0.72)	-	2 (1.19)	-	-	-	
Lipoma	6 (4.44)	2 (1.48)	3 (2.22)	-	-	-	-	1 (0.74)	
Benign mass	13 (3.83)	4 (1.17)	-	-	7 (2.06)	-	2 (0.59)	-	
Skin tag	2 (2.38)	1 (1.19)	-	-	1 (1.19)	-	-	-	
Wart	5 (10.64)	1 (2.12)	-	-	3 (6.38)	-	1 (2.12)	-	
Delayed suture wound	7 (18.92)	2 (5.40)	-	-	4 (10.81)	-	1 (2.70)	-	
Infected wound	1 (3.26)	1 (3.22)	-	-	-	-	-	-	
Ganglion cyst	3 (25.00)	1 (8.33)	-	-	1 (8.33)	-	1 (8.33)	-	
Keloid	7 (12.50)	-	-	-	2 (3.57)	5 (8.9)	-	-	
Malignancy	1 (1.56)	-	-	-	1 (1.56)	-	-	-	
Other	1 (25.00)	-	-	1 (25.00)	-	-	-	-	
Operation (% of each operation)									0.83
Excision	53 (5.48)	16 (1.65)	5 (0.52)	1 (0.10)	20 (2.07)	5 (0.52)	5 (0.52)	1 (0.10)	
Incision	2 (1.98)	1 (0.99)	-	-	1 (0.99)	-	-	-	
I&D	4 (1.57)	2 (0.78)	-	1 (0.39)	1 (0.39)	-	-	-	
Suture wound	9 (17.64)	4 (7.84)	-	-	4 (7.84)	-	1 (1.96)	-	
Location (% of each location)									0.00
Scalp	3 (6.52)	-	1 (2.17)	-	2 (4.35)	-	-	-	
Face	14 (4.29)	2 (0.66)	-	1 (0.33)	5 (1.65)	3 (0.99)	3 (0.99)	-	
Neck	2 (2.47)	-	1 (1.23)	-	-	-	-	1 (1.23)	
Anterior chest wall	2 (2.82)	1 (1.41)	-	1 (1.41)	-	-	-	-	
Posterior chest wall	12 (7.59)	7 (4.43)	-	-	3 (1.90)	1 (0.63)	1 (0.63)	-	
Abdomen	2 (5.26)	-	1 (2.63)	-	1 (2.63)	-	-	-	
Lower back	7 (7.14)	3 (3.06)	1 (1.02)	-	3 (3.06)	-	-	-	
Buttock	6 (6.45)	2 (2.15)	1 (1.08)	-	3 (3.26)	-	-	-	
Arm and forearm	2 (1.77)	1 (0.88)	-	-	-	-	1 (0.88)	-	
Hand and wrist	2 (2.67)	-	-	-	2 (2.67)	-	-	-	
Leg	8 (6.35)	4 (3.17)	-	-	4 (3.17)	-	-	-	
Foot and ankle	8 (2.89)	3 (1.09)	-	-	3 (1.09)	2 (0.72)	-	-	

Data presented in number (%)

In our subgroup analysis focusing on specific risk factors, infectious complications were found to be strongly associated with several factors, including an operative time of more than 30 minutes, a lesion size exceeding 2 cm, and the absence of intra-operative wound irrigation. These factors exhibited odds ratios of 13.3, 5.2, and 8.9, respectively. In the group of wound dehiscence complications, an operative time exceeding 30 minutes, lesion size larger than 2 cm, and the use of either one or two layers of suture were not statistically significant factors. However, in the hematoma and bleeding group, a lesion size exceeding 2 cm was found to be a substantial risk factor, with an odds ratio of 10.6 (Table 4).

Table 4 Subgroup analysis

Risk factor	OR	95% CI	*p*-value
Infection			
Operation time > 30 min	13.30	3.03 - 58.46	0.00
Size more than 2 cm	5.24	1.88 - 14.57	0.01
No wound irrigation	8.90	3.13 - 25.31	0.01
Dehiscence			
Operation time > 30 min	0.70	0.27 - 1.85	0.47
Size more than 2 cm	0.22	0.03 - 1.70	0.14
Suture one layer	0.83	0.80 - 0.86	0.14
Suture both layers	0.74	0.70 - 0.79	0.34
Hematoma / Bleeding			
Operation time > 30 min	4.03	0.67 - 24.02	0.13
Size more than 2 cm	10.61	1.18 - 95.23	0.02
Adrenaline within Xylocaine	0.85	0.83 - 0.87	1.00
Cauterization	3.47	0.58 - 20.83	0.17
Compression dressing	4.76	0.53 - 43.14	0.23

Data presented as OR, CI

The total number of residents included in this study was 123, with 88.7% being first-year surgical residents and 11.4% third-year plastic surgical residents. The average complications per resident per case each year were 0.04 ± 0.11 and 0.08 ± 0.17, respectively, for the two resident groups. Among these residents, 42.7% had graduated from the Faculty of Medicine, Siriraj Hospital, while 52.9% had graduated from other medical schools. The mean complications per doctor per case in each graduation school were 0.05 ± 0.11 and 0.04 ± 0.13, respectively (Table 5). In terms of the academic quarter, 35.9% of complications occurred during the first academic quarter, while 64% occurred during the rest of the academic year, with a *p*-value of 0.56 (Table 6).

Table 5 Resident factors

	Person (%)	Complications (times/person/case)	*p*-value
Residency year			0.14
First-year	109 (88.62)	0.04 ± 0.11	
Third year	14 (11.38)	0.08 ± 0.17	
Medical school			0.28
Siriraj	58 (47.15)	0.05 ± 0.11	
Other medical school	65 (52.85)	0.04 ± 0.13	
Internship			0.39
General intern	92 (74.80)	0.06 ± 0.14	
Surgery internship	31 (25.20)	0.02 ± 0.42	
Division			0.27
General surgery	51 (41.5)	0.05 ± 0.15	
Neurosurgery	10 (8.1)	0.02 ± 0.05	
Cardiothoracic surgery	11 (8.9)	0.04 ± 0.05	
Pediatric surgery	15 (12.2)	0.04 ± 0.06	
Urosurgery	7 (5.7)	0.01 ± 0.03	
Orthopedic	4 (3.3)	0.08 ± 0.17	
Plastic surgery (First year)	11 (9.9)	0.07 ± 0.07	
Plastic surgery (Third year)	14 (11.4)	0.08 ± 0.17	

Data presented as the mean ± S.D., number (%)

Table 6 Resident factors with July effect

Academic quarter	Cases	Complications	OR	95% CI	*p*-value
First academic quarter					
(1 July 2016 - 30 Sep 2016)	255 (31.7)	14 (35.9)	0.82	0.42 - 1.60	0.56
Other academic quarters					
(1 Oct 2016 - 30 June 2017)	550 (68.3)	25 (64.1)	0.82	0.42 - 1.60	0.56
Total	**805**	**39**			

Data presented as the mean ± S.D., number (%)

Discussion

In worldwide surgical training programs, minor surgical procedures are a fundamental requirement for resident surgeons. They are performed in clinics that are colloquially known as "lumps and bumps clinics".[10,11] The excision of skin and soft tissue lesions is an operation that all Thai surgical residents have to successfully perform within their first year of training according to the Thai Board of Surgery curriculum. As part of the surgical training at our hospital, these procedures are the responsibility of first-year surgical residents.[12] because such minor surgical operations are not considered major complicated, require minimal time, and have the risk of only minor complications. Moreover, they can improve surgical skills and operative autonomy, which benefits junior surgical residents.[1]

In line with the general characteristics of the clinic, there were no definite follow-up times for minor surgical cases.

During the study period at the OR minor clinic in our hospital, the average duration of follow-up was 11.3 ± 11.6 days with 2.1 ± 2.8 mean follow-up visits. Due to the nature of this clinic, which primarily performs uncomplicated procedures, such as superficial lesion excisions or incisions and drainage, the duration of follow-up in this clinic was shorter than in the other post-operative clinic. Moreover, the middle half of the patient age group ranged from 35 to 65 years old, which is an age group that can independently take care of themselves post-operatively. In comparison, a retrospective review of 1,572 operations in Canada reported 68 days of follow-up time in a pediatric population because of concerns about scarring and pediatric well-being.[13]

Most common soft tissue tumors are benign. Compared to malignancies, the report from the USA confirmed a ratio of 150 cases of benign masses per one malignant mass.[14] In our study, we found 64 cases to be malignant and 726 to be benign masses. Due to our hospital's status as a tertiary care center, the number of malignant masses might be higher than that in the general population, especially in the field of plastic specialization. Interestingly, the first-year residents handled only two cases of malignant masses. This finding requires consideration due to the responsibility of the graduate surgeons in Thailand, who may encounter both benign and malignant masses.

Surgical residents perform various operations. According to a study at Massachusetts General Hospital by Wojcik BM et al. (2016), the most common operation was excision, accounting for 78.2% of the total 110 operations performed by the surgical residents at the hospital. Following that, incision and drainage accounted for 10.0%.[1] Similarly, in our study, the first and second most common operations were excision, incision, and drainage, representing 61.5% and 16.2% of all procedures, respectively.

The complications we identified in these operations were neither fatal, leading to systemic infections, nor necessitated further major surgery. Overall, the complications in this study accounted for 4.3% of cases, which was slightly higher than the findings in the Massachusetts study. That study reported a complication rate from minor surgeries performed by surgical residents as 3.6%,[1] encompassing surgical site infections (SSIs), wound dehiscence, hematoma or bleeding, seroma, and superficial necrosis.

The US Centers for Disease Control and Prevention defined SSIs as an infectious process that occurs only at the skin and subcutaneous tissue of the incision site within 30 days after a procedure. Further, this infectious process must meet at least one of the following conditions: purulent discharge from the superficial incision, isolation of organisms from a fluid or tissue culture, surgical site tenderness, swelling, heat, redness, or a diagnosis of SSI by the surgeon.[14] To consider, we typically diagnose this condition based on clinical presentation and rarely send specimens for culture or organism isolation. Our study's rate of infectious complications was 1.5% out of 1,572 operations. Similarly, the approximate percentage of infectious complications for skin and superficial soft tissue surgery in other studies ranged from 0.6% - 4.0%.[15-17]

In the excision group, an operative time exceeding 30 minutes was found to be associated with SSI. A systematic review of the relationship between SSI and operative time concluded that a prolonged operative time increased the likelihood of SSI complications across a wide range of procedures, with an average of 30 minutes longer operative time observed in patients with SSI compared to the non-SSI group.[3] Other significant risk factors related to infectious complications included the size of the lesion and wound irrigation.

Wound dehiscence refers to the separation of previously approximated wound edges, which occurs due to a failure in the proper wound-healing process.[18] Several factors contribute to appropriate wound closure, including the wound type, location, underlying diseases, closure materials, and surgical techniques.[19] The significant risk factors for wound dehiscence in a wide range of surgical procedures include obesity, diabetes mellitus, a history of smoking, age over 65 years old, wound infection, and inadequate surgical closure.[18] Areas of the body with high tension, such as the back, chest, and deltoid, have an increased likelihood of wound dehiscence, as noted by Campbell et al.[20] In a study conducted by Amici et al., an operative time of more than 24 minutes was identified as a significant risk factor for hemorrhagic complications in dermatosurgical procedures[2] However, in our findings, an operative time exceeding 30 minutes, lesions larger than 2 cm, and the use of either one or two layers of sutures were not statistically significant factors.

Hemorrhagic complications are among the significant post-operative issues, and they have the potential to lead to other complications, such as surgical site infection, wound dehiscence, or skin necrosis.

Previous studies have indicated that factors such as age, location, defect size, and the use of anticoagulant agents were associated with postoperative bleeding, with an average hemorrhagic complication rate ranging from 1.6% - 7.1%.[21-23] In contrast, our study revealed that only 0.3% of cases were counted as post-operative bleeding, and none of these cases required operative management. We found that a defect size exceeding 2 cm was a significant risk factor. However, operative time, the presence of adrenaline in a lidocaine injection, cauterization, and the use of compression dressing were not statistically significant risk factors. This contradicts previous data that suggested that adrenaline in a lidocaine injection, cauterization, and compression dressing were effective techniques for preventing hemorrhagic complications.[24] This discrepancy may be due to the increased awareness among surgeons who already employ these techniques to prevent post-operative bleeding. It is important to note that one limitation of our study was the low number of bleeding complications, which could have contributed to the insignificant result.

Siriraj Hospital is one of Thailand's largest tertiary referral hospitals and the biggest surgical training center. Consequently, novice surgical residents are recruited for each training year from various medical centers across all regions of Thailand. Concerns have arisen regarding whether medical students graduating from tertiary hospitals would perform better than those from regional hospitals. However, the average complication rates among graduates from Siriraj Medical Center and other medical centers showed no statistically significant differences. This finding aligns with a study conducted in Australia, which demonstrated that the academic performance of medical students, regardless of whether they graduated from a tertiary center or other institution, did not differ.[6] The career path for surgeons in Thailand typically begins with six years as a medical student, followed by at least one year as an internist, and finally, four years as a surgical resident. During the internship period, individuals may assume various roles, including that of a general practitioner or surgical intern. Regarding internist experience, no statistically significant differences were observed in terms of complication rates between general practitioners and surgical interns.

The residency training program at our hospital comprises six divisions: General Surgery, Neurosurgery, Cardiothoracic Surgery, Pediatric Surgery, Urology, and Plastic Surgery. All first-year surgical residents are assigned to the minor operation clinic to enhance their autonomy and surgical skills. Additionally, first-year residents from the orthopedic department participate in this clinic. This study's results confirmed no significant difference in average complication rates among residents from the different divisions.

The 'July effect' concept is commonly mentioned as a factor related to the academic year changeover. A systematic review of studies published between 1989 and 2010 indeed demonstrated that the mortality rate during this period was higher than during the rest of the year.[8] Interestingly, no 'July effect' was observed during the rotation of Siriraj surgical residents. Complications that occurred during the first quarter were comparable to those in other quarters. This observation may have resulted from the relatively low complexity of procedures, and most of the procedures were performed during the medical student to internship periods. Consequently, surgical staff should remain consistently attentive to complications in minor operations throughout the surgical training year without any specific period of heightened concern.

Because senior residents who were in the plastic surgery program performed the procedures for the intricate cases, the results showed no statistically significant difference between the first-year and third-year surgical residents in this study who performed the minor procedures.

This research has some limitations to note. The completeness of the medical records was a significant concern, as all records were handwritten, and some data might have been missing. Therefore, the reported complications could potentially be lower than the actual number of complications. Additionally, a portion of the patients did not reach the intended follow-up periods, possibly due to difficulties in accessing a tertiary hospital. Consequently, it is essential to consider these limitations when interpreting the results.

Conclusion

The complications associated with minor operations performed by residents at Siriraj Hospital were similar to those in previous studies. Several factors influenced these complications, particularly an operative time exceeding 30 minutes and lesion sizes larger than 2 centimeters. However, our results indicated there was no 'July effect' throughout the academic quarters. Ultimately, the findings

of this study should be considered as a guide for improving the surgical residency training curriculum at Siriraj Hospital.

Conflicts of Interest

There is nothing to declare.

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Case Report

Case Report on a Mitten Hand Contracture in Epidermolysis Bullosa

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Abstract Epidermolysis Bullosa is a disorder characterized by skin fragility. Repetitive injury followed by healing can result in severe deformity due to scarring. The available evidence on whether surgery enhances hand function is somewhat inconclusive because there is a shortage of large, well-controlled studies. Nevertheless, the majority of the data suggest that surgery has the potential to enhance hand function. We present a case of Epidermolysis Bullosa in a 6-year-old patient who presented with bilateral mitten hand deformity. Right-hand contracture, pseudosyndactyly release, and defect resurfacing with a full-thickness skin graft (FTSG) were done. The patient had a smooth recovery and regained the ability to grasp objects.

Keywords: Epidermolysis bullosa, Hand deformities, Skin transplantation

Introduction

Epidermolysis Bullosa is characterized by skin fragility, which causes blisters to form even in response to minimal mechanical stress and results in a breakdown of the dermo-epidermal junction. It covers a broad spectrum of clinical presentations affecting the skin and other body systems due to the absence of essential adhesion proteins. This is caused by mutations leading to the loss of function in the genes encoding laminin 332 or type VII collagen to milder forms of skin fragility brought on by minute molecular anomalies, such as single amino acid substitutions.[1,2] The shearing force from daily activities makes the hand more susceptible to injury. Blisters can be superficial and result in erosions or more substantial, resulting in ulcerations. Contractures, pseudosyndactyly, mitten deformity, nail loss, and atrophy of the finger and thumb tips are brought on by progressive scarring.[3-5] Surgery can be used to correct hand deformity caused by Epidermolysis Bullosa because they generally result in considerable physical disabilities and decreased quality of life.[6] However, there is currently no solid data foundation on which to design surgical therapy of the hand in Epidermolysis Bullosa.[4] We describe the operation performed on a 6-year-old Epidermolysis Bullosa patient.

Case Presentation

A 6-year-old girl with Epidermolysis bullosa was referred to our team following the development of mitten hand deformity in both her hands (Figure 1). She had this deformity for 2 years and has been losing the function of her hands. She had previously been able to write and play with toys due to her intact pinch and grip functions. The disease's progressive nature resulted in severe flexion contractures, hence losing these abilities. She has not been able to seek medical attention since 2019 due to the COVID-19 pandemic, resulting in the rapid progression of the disease.

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Figure 1 Bilateral mitten hand deformity

Figure 2 Contracture release on the right hand at the level of the MCP and PIP joint with pseudosyndactyly release

Figure 3 90° flexion of PIP joint and full release of the pseudosyndactyly

Figure 4 Child regains the ability to grasp objects 3 months after surgery.

Detailed multidisciplinary discussions with the pediatric, pediatric intensivist, and dermatology team concluded that surgery could be performed to prevent further loss of function and aid in the child's developmental milestones. The surgery of choice was a contracture release on the right hand at the level of the metacarpal phalangeal joint (MCPJ) with pseudosyndactyly release. A full-thickness skin graft (FTSG) harvested from the right infraclavicular region was used to cover the MCPJ due to limited donor sites and the high risk of donor site morbidity if a split skin graft is taken.

Release was initiated, freeing the fingertips from the palm, and continued towards the metacarpophalangeal joints. Gentle and steady traction was applied without shearing forces (Figure 2). We were able to obtain a 90° flexion of the proximal interphalangeal joint (PIP) and full release of the pseudosyndactyly (Figure 3). A full release of the scar was limited by joint contracture, limited skin graft donor site, and difficult dissection due to skin fragility.

A full-thickness skin graft was applied over the MCPJ, and the other areas were dressed with modern dressings, as dermal elements were preserved throughout. Subsequent dressing changes were performed weekly under general anesthesia for a month. A custom-made padded splint was applied after the wounds were healed to maintain the hand in a functional position. The patient had a smooth recovery and regained the ability to grasp objects after the operation (Figure 4).

Discussion

Epidermolysis Bullosa is a group of rare genetic disorders. According to the National Epidermolysis Bullosa Registry, the incidence of epidermolysis bullosa is 1 in every 51,000 live births in the United States, with a frequency of 11.1 per million live births.[7]

The morphological study of a skin sample by immunohistological approaches, as well as the mutational investigation of the candidate gene, are used to diagnose and classify EB.[2] Epidermolysis Bullosa is divided into four basic types: simplex (70%), dystrophic (25%), junctional (5%), and Kindler syndrome; nonetheless, the first three subtypes account for 99% of the patient population.[2,8]

Epidermolysis bullosa negatively affects quality of life and places a financial burden on patients and their families, according to a survey by Anna et al. This includes frequent hospital visits, not working or working fewer hours, pain and itching, wound care, divorce or separation, limited daily activities, socialization, and emotional stress. Patients and carers indicated that the average amount (in USD) spent on epidermolysis bullosa care per month was $262.34 and $682.16, respectively.[6]

A comprehensive multidisciplinary team strategy that prioritizes the patient's needs is critical.[3,4,9] Our patient was referred early to the Pediatric Dermatology and Pediatric Intensive Care teams for planning. Early admission was vital to optimizing chronic normochromic normocytic anemia and electrolyte imbalances. A minimal touch guideline was established to guide the process of transfer, intubation, surgery, extubation, and post-surgical care to decrease further skin damage.

The available evidence on whether surgery enhances hand function is somewhat inconclusive because there is a shortage of large, well-controlled studies. Nevertheless, the majority of the data suggest that surgery has the potential to enhance hand function.[3] There are numerous methods described for managing and covering wounds after contracture release, but as of now, there is no consensus on the preferred approach.[10]

FTSG, split-thickness skin graft (SSG), dermal graft, skin substitutes, and non-adhesive dressings are among the approaches documented.[4-6,11,12] We performed an FTSG and contemporary dressing because full-thickness grafts are generally recommended due to superior functional outcomes and lesser risk for secondary contracture formation, and split-thickness skin grafts were not advantageous for graft take.[13,14] There was also the fear of a nonhealing donor site following a split-thickness skin graft harvest, and harvesting an FTSG allowed us to close the wound primarily. Skin substitutes were not available for our patient.

Following surgery, the hand therapist created a custom-made padded splint and performed controlled active mobilization of the metacarpophalangeal joints and interphalangeal joints after 1 month. These splints were maintained for 3 months and reduced to night splinting for a total of 1 year. Long-term use of splints has been linked to the avoidance of recurring hand contractures.[4,15]

Conclusion

Surgical correction of mitten hand contracture in epidermolysis bullosa can improve a patient's quality of life. The surgery has allowed the child to regain the ability to grasp objects, a critical factor in cognitive and physical development. However, extended follow-up is required to confirm the long-term maintenance of hand function. Additionally, a more significant number of cases and studies are needed to provide further support for the observed outcome.

Conflict of interest

The authors do not have any conflict of interest.

Consent

Written consent has been taken from the parents.

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Case Report

Identification of a Pathogenic Germline Variant in the BRCA2 Gene in a Patient Diagnosed with Ductal Carcinoma in Situ (DCIS): A Case Report and Review of the Literature

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Abstract Advances in sequencing technology are rapidly progressing, leading to reduced costs and enhanced accessibility to genetic testing for cancers. Thailand, classified as a middle-income nation, integrates Universal Coverage of public health insurance to encompass germline genetic testing for breast cancer (BC) patients and their relatives who are at high risk of Hereditary Breast and Ovarian Cancer Syndrome (HBOC). In this study, we describe the case of a 48-year-old woman diagnosed with Ductal Carcinoma in Situ (DCIS) who underwent genetic testing, which revealed the presence of a pathogenic germline variant in the *BRCA2* gene. The test was also conducted on three children. The findings indicate that two of three children carry pathogenic germline variants similar to those identified in their mother. The patient and their family members, who presented with both inherited and non-inherited *BRCA2* germline mutations, underwent counseling sessions delivered by certified genetic counselors. Moreover, implementing cancer surveillance and risk reduction strategies for individuals with inherited *BRCA2* germline mutations, encompassing BC, ovarian cancer, prostate cancer, pancreatic cancer, and malignant melanoma, offers significant advantages for this familial cohort.

Keywords: Breast cancer, Germline mutation, *BRCA*

Introduction

The etiology of Hereditary Breast And Ovarian Cancer Syndrome (HBOC) frequently involves the presence of deleterious germline mutations within the *BRCA1/2* genes.[1] The presence of the *BRCA2* pathogenic germline variants has been associated with a projected cumulative risk of 45% for breast cancer (BC) and 11% for ovarian cancer by age 70.[2] Undertaking a risk-reducing bilateral salpingo-oophorectomy and a mastectomy yields a pronounced diminution in the susceptibility to cancer.[3] The administration of Olaparib, a Poly ADP-Ribose Polymerase (PARP) inhibitor, demonstrates enhanced survival outcomes in individuals with locally advanced or metastatic BC who harbor *BRCA* germline mutations.[4] Germline genetic testing confers a plethora of advantageous outcomes for individuals diagnosed with BC.[5]

We present herein a case study detailing the condition of a 48-year-old Thai woman affected with ductal carcinoma in situ (DCIS) of the breast. It is noteworthy

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that the patient harbored a *BRCA2* pathogenic germline variant, which has been subsequently transmitted to two out of her three offspring.

Case Presentation

A woman 48 years of age presented with a discernible mass in the outermost region of the upper left breast. She had not observed any changes in the lump size and had not previously encountered any associated discomfort. The physical examination revealed a palpable irregularity characterized by a 4-cm firm consistency mass located in the upper outer quadrant of the left breast and fixed to the surrounding tissue. Additional physical examinations showed an absence of nipple discharge and no palpable lymph nodes, including those in the axillary region. Other examinations were unremarkable. The patient negated any history of underlying medical conditions and denied the presence of cancer in her family, particularly breast and ovarian malignancies (Figure 1).

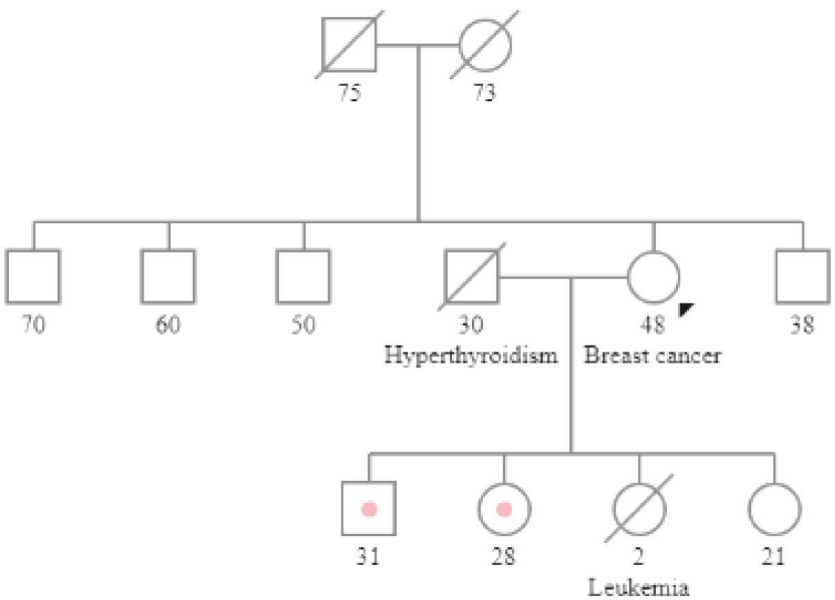

Figure 1 Pedigree of the family with a germline *BRCA2* mutation

The radiological assessment of both breasts reveals an irregular hypodense mass in the left breast's upper outer region, measuring 1.4 × 4.6 × 5.4 cm in dimensions. Due to the potential risk of BC, the physician conducted a biopsy utilizing a core needle biopsy technique for subsequent histopathological examination, which reported DCIS.

Following a thorough consultation, the patient made the informed decision to undergo a left mastectomy, opting not to conserve her breast. The patient underwent a left mastectomy accompanied by a sentinel lymph node biopsy. The postoperative pathological findings indicate the absence of any margin involvement in high-grade DCIS and no evidence of metastasis in all four nodes examined. The immunohistochemical analysis of examination results revealed the tumor to be estrogen receptor (ER) positive, progesterone receptor (PR) negative, human epidermal growth factor receptor 2 (HER2) negative, with a Ki-67 proliferation index of 35%. Tamoxifen at a daily dosage of 20 mg is administered post-surgery to mitigate the risk of invasive BC in the patient.

The patient underwent germline genetic testing utilizing Next-Generation Sequencing (NGS) technology, specifically a panel test encompassing multiple genes. She underwent pretest counseling facilitated by individuals who have completed training in genetic counseling and obtained certification through the Training Curriculum in Genetic Counseling. After verification through the standard dideoxynucleotide test (Sanger sequencing). The germline genetic testing results indicate the patient harbored a germline mutation in the *BRCA2* gene. The mutation involved a deletion of two bases, leading to

a frameshift mutation identified as NM_000059.4(BRCA2):c.3680_3681del, rs80359395, NP_000050.3:p.Leu1227fs. The Sanger sequencing technique was employed to conduct germline genetic testing on all three offspring of the patient. Each of the three children underwent pre-test and post-test genetic counseling. The results of germline genetic testing indicated that one son and one daughter are carriers of the *BRCA2* mutation, whereas the youngest daughter exhibits a wild-type genetic profile (Figure 2). The daughter, with the wild-type genotype, is advised that she had an ordinary susceptibility risk to cancer development.

Figure 2 The Sanger sequencing outcomes for the patient's familial genetic analysis.
A: A 47-year-old female diagnosed with breast cancer (index patient). A 30-year-old son., A 27-year-old daughter. B: A 20-year-old daughter (Wild type).

The strategic handling of a BC patient extended to the comprehensive management of a familial case involving both a male and female offspring, each harboring the *BRCA2* pathogenic germline variant. Guidance for individuals and their familial counterparts harboring the *BRCA2* germline mutation was formulated in accordance with the recommendations delineated in the 2024 edition of The National Comprehensive Cancer Network (NCCN) guidelines. All family members who underwent genetic counseling and *BRCA* testing were recommended to adopt lifestyle modifications aimed at reducing their risk of cancer. Recommendations for individuals encountering DCIS at the age of 48 involve undergoing contralateral risk-reduction mastectomy along with risk-reducing salpingo-oophorectomy. Despite the patient's refusal of surgical intervention, the suggested course of action entails the implementation of an annual mammogram and breast Magnetic Resonance Imaging (MRI) screening for the unaffected breast. In the case of a 28-year-old daughter bearing the *BRCA2* mutation, a regimen of annual breast MRI screenings has been initiated, yielding consistently negative results. The discussion regarding risk-benefit analysis concerning the utilization of risk-reducing interventions like bilateral

mastectomy and bilateral salpingo-oophorectomy following childbirth necessitates meticulous consideration. In the case of a 31-year-old male with a *BRCA2* germline mutation, it is advisable to commence a routine of breast self-examination and clinical breast examination every 12 months, initiating the screenings at the age of 35 years. Prostate cancer screening is advised, encompassing an annual prostate-specific antigen (PSA) test commencing at the age of 40. For individuals harboring the *BRCA2* germline mutation, the initiation of pancreatic cancer screening is recommended at the age of 50 years. Modalities such as MRI, magnetic resonance cholangiopancreatography (MRCP), and/or endoscopic ultrasound (EUS) are indicated for comprehensive screening. Melanoma poses an elevated risk, notwithstanding the absence of screening programs advocating. It is advised to refrain from ultraviolet exposure.

Discussion

BRCA2 plays a crucial role in DNA repair, and mutations in this gene impart a substantially elevated lifetime risk of BC, typically ranging from 50% to 80%.[6] The *BRCA2* germline mutation associated with HBOC has documented over 3,400 variants classified as pathogenic mutations.[7] Not only linked to breast and ovarian cancers, mutations of *BRCA2* also to other malignancies, including those affecting the pancreas, prostate, and melanoma[8] The biallelic *BRCA2* germline mutation results in Fanconi anemia syndrome, an uncommon genetic disorder that impacts the bone marrow and escalates the susceptibility to hematologic malignancies.[9] A familial member is dead of a hematologic malignancy at the age of two. Yet, the available data does not substantiate the association of Fanconi anemia as the causative factor for the malignancy.

Since 2013, the prevalence of *BRCA1/2* genetic testing has experienced a notable surge attributed to what has become known as the Angelina Jolie Effect.[10] Furthermore, there has been an elevated incidence of contralateral risk reduction mastectomy among individuals diagnosed with BC.[11] In Thailand, the Universal Coverage public health insurance scheme integrated *BRCA* testing for BC patients into its coverage package in 2023. The criteria set forth by Thailand for genetic testing (*BRCA1/2*) in individuals diagnosed with BC are as follows: I. Diagnosis of BC at an age less than 46 years. II. Diagnosis of BC between the ages of 46 and 50 with multiple primary BC. III. Diagnosis of BC at any age with Triple-negative breast cancer (TNBC), male BC, or a family history of breast, ovarian, pancreatic, or prostate cancer among close relatives. The primary individual within this family, referred to as the index case, was diagnosed with DCIS, characterized as a form of noninvasive BC, at the age of 48. The American Society of Breast Surgeons advocates for universal genetic testing benefits for all individuals diagnosed with BC.[5] The NCCN clinical practice guidelines in oncology version 3.2024 define DCIS as non-invasive BC and recommend genetic testing for individuals with a personal history of BC and age younger than 51 years. The American Society of Clinical Oncology (ASCO) recommends that *BRCA1/2* testing be offered to all patients under the age of 66 who are newly diagnosed with stage I-III BC.[12] Germline genetic testing for *BRCA1* and *BRCA2* demonstrates significant cost-effectiveness in benefiting family members within Thailand, a middle-income nation characterized by resource-constrained environments.[13] Conducting multigene panel testing for all women diagnosed with BC proves to be a cost-effective approach.[14]

BRCA1/2 represents a widely recognized gene linked to susceptibility to BC. In addition to *BRCA1/2*, numerous other genes are implicated in BC etiology. According to the database www.omim.org, there are 21 genes identified as having substantial associations with BC. Germline variation is correlated with heightened susceptibility to BC, with variations in specific genes influencing the absolute risk by age 80. For instance, the absolute risk by age 80 associated with various genes is as follows: *BRCA1* (75%), *BRCA2* (76%), *CDH1* (53%), *PALB2* (45%), *CHEK2* (29%), *ATM* (27%), and *NF1* (26%).[15] A germline mutation in *PTEN* significantly elevates the risk of breast cancer in women by approximately 67% to 85% by the age of 70. Consequently, individuals with dense breast tissue are recommended to undergo annual mammograms or breast MRIs starting at the age of 30.[16] A research investigation involving 1,663 BC patients in Brazil revealed that 20.1% of them harbored germline mutations in at least one gene, with 10.1% of the total patient cohort carrying mutations in *BRCA1/2* genes.[17] A cohort study encompassing 480 BC patients of ethnic Chinese descent in Taiwan revealed a 13.5% prevalence of germline mutations. Among these, 61.5% carried mutations in *BRCA1/2* genes, while 39.5% carried mutations in genes other than *BRCA1/2*.[18] A study conducted among 151 BC patients in the southernmost region of Thailand

revealed that 15.2% had germline mutations, with 32% attributable to *BRCA1/2* genes and 68% associated with genes other than *BRCA1/2*.[19]

For individuals identified as *BRCA*-positive carriers within the age range of 25–29 years, the NCCN guideline version 3.2024 recommends annual breast MRI screening. The recommendation is further personalized based on familial history, particularly in cases where a diagnosis of BC occurred before the age of 30. In Thailand, there could be restrictions on the frequency of annual MRI breast examinations. In such cases, the NCCN recommends opting for yearly mammograms as an alternative in instances where MRI screening is unavailable. For individuals aged between 30 and 75 years, the NCCN recommends undergoing both annual mammography and breast MRI screenings. For individuals carrying the *BRCA2* mutation, the European Society for Medical Oncology (ESMO) advises undergoing annual ultrasound examinations, optionally complemented with mammography if MRI breast imaging is inaccessible. This screening protocol typically begins 30 or five years earlier than the age of diagnosis of BC in the youngest affected family member.[20]

In conclusion, we present a non-invasive BC case, underscored by the potential benefits for family members through germline genetic testing. The *BRCA1/2* genetic test offers significant advantages in managing BC patients and their familial relatives.

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Ethical Declaration

The study protocol was approved by the Human Research Ethics Committee of Naradhiwas Rajanagarindra Hospital (REC 001/2564). The study was conducted according to good clinical practice and the Declaration of Helsinki.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Conflict of Interest

The authors declare no conflict of interest.

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