e-ISSN:2602-2079

Volume 9
Issue 2
2025

# JOURNAL of Surgery and Medicine

International Medical Journal

JOSAM

# Editorial Team

Prasenjit Das, Professor, MD, DNB, MNAMS, MNASc
Department of Pathology
All India Institute of Medical Sciences
New Delhi, India
Website

Seyed Vahid Hosseini, Professor
Shiraz University of Medical Sciences, Shiraz, Iran
Website

# Vol. 9 No. 2 (2025)


**Published:** 2025-03-01

## Research Article



## Case Report

J Surg Med. 2025;9(2):18-22.
https://doi.org/10.28982/josam.8054

JOSAM

Journal of Surgery and Medicine

e-ISSN: 2602-2079

Research article
https://jsurgmed.com/

# Endoscopic versus microscopic tympanoplasty: A prospective randomized comparison of outcomes

**Burak Ulkumen [1], Ali Vefa Yuceturk [2]**

[1] Department of Otorhinolaryngology, Manisa Celal Bayar University-Faculty of Medicine, Hafsa Sultan Hospital, Manisa, Turkey
[2] Department of Otorhinolaryngology, Can Hospital, İzmir, Turkey

**ORCID of the author(s)**

BU: https://orcid.org/0000-0003-1981-5886
AVY: https://orcid.org/0000-0002-7944-1188

**Corresponding Author**
Burak Ulkumen
Uncubozköy, Celal Bayar Ünv., 45030
Yunusemre, Manisa, Turkey
E-mail: drburak@gmail.com

**Ethics Committee Approval**
The study was approved by the Manisa Celal Bayar University Faculty of Medicine, Health Sciences Ethics Committee (number 20.478.486) on November 14, 2018.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

**Conflict of Interest**
No conflict of interest was declared by the authors.

**Financial Disclosure**
The research was financed by the Unit of Scientific Research Projects (BAP) of Manisa Celal Bayar University (Grant number 2018-205). The full trial protocol can be accessed online at the website of the Unit of Scientific Research Projects (BAP) of Manisa Celal Bayar University.

**Published**
2025 February 11



## Abstract

**Background/Aim:** There is a limited number of systematic comparisons and comprehensive studies on auditory outcomes, graft success, and complication rates between traditional microscopic and newer endoscopic tympanoplasty techniques. Hence, we aim to compare these two techniques, namely endoscopic and microscopic type-1 tympanoplasty, in terms of anatomical and functional outcomes.
**Methods:** This prospective randomized clinical trial included 40 adult patients, divided equally between those undergoing microscopic and endoscopic tympanoplasty. To eliminate selection bias, the sequence of operations alternated between the two methods based on the patients' arrival order. Each patient's pre-operative conditions and outcomes 6 months post-surgery were evaluated using pure tone audiometry tests and assessments of the tympanic membrane. For both groups, the tragal perichondrial cartilage composite graft served as graft material. Functional assessments evaluated the air conduction threshold and bone conduction threshold averages at frequencies of 500, 1000, 2000, and 4000 Hz, both pre-operatively and 3 months after the operation. Air conduction gain was determined by comparing the air bone gap at application with that 6 months post-surgery. The size of the tympanic membrane perforation was calculated as a percentage of the total area using ImageJ, and the correlation with functional gain was assessed. The condition of the tympanic membrane and graft position were documented 6 months post-surgery using IBM SPSS Statistics Version 26.
**Results:** We compared mean (standard deviation [SD]) pre-operative air conduction threshold values between the endoscopic group (30.11 [5.19]) and the microscopic group (28.45 [5.19]) and found no significant difference ($P$=0.404). Similarly, we found no significant difference ($P$=0.169) in pre-operative air bone gap values between the endoscopic group (24.58 [5.35]) and the microscopic group (27.17 [6.34]). Post-operative air conduction threshold values in the endoscopic group (17.09 [11.28]) and the microscopic group (13.55 [7.99]) also showed no significant difference ($P$=0.258). The same was true for post-operative air bone gap values in the endoscopic group (13.97 [10.91]) and the microscopic group (9.63 [7.83]) ($P$=0.156). The average air conduction gain, an indicator we used to evaluate the functional success of the surgery, was similarly non-significant between the endoscopic group (13.08 [7.47]) and the microscopic group (14.90 [5.04]) ($P$=0.395).
**Conclusion:** Our study findings suggest that an endoscope is at least as effective as the microscopic method in type-1 tympanoplasty. Moreover, with advantages like reduced surgical time and broad-angle viewing capabilities, the endoscopic method is poised to gain popularity.

**Keywords:** tympanoplasty, endoscopic, microscopic, functional outcome, type-1

How to cite: Ulkumen B, Yuceturk AV. Endoscopic versus microscopic tympanoplasty: A prospective randomized comparison of outcomes. J Surg Med. 2025;9(2):18-22.

## Introduction

Chronic otitis media (COM) is a persistent inflammation of the middle ear mucosa, typically caused by resistant infections. If COM is untreated or improperly treated, complications like tympanic membrane perforation and hearing loss can occur [1]. In dealing with COM and tympanic membrane perforation, tympanoplasty is a common surgical method. This procedure was first introduced by Wullstein in 1952 [2], followed by Zöllner in 1955 [3]. Wullstein further classified the technique into five subtypes in 1956 [4], with Type-1 tympanoplasty being defined as the repair of only the tympanic membrane without disturbing the ossicular chain. Unlike myringoplasty, it includes creating a tympanomeatal flap [5,6]. Various graft materials and surgical techniques have emerged since the first description of this method. Temporalis fascia (TF) was the usual graft material for a long time until cartilage and perichondrium became popular. These two, having the same origin as TF, offer higher resistance [7] and, hence, result in a higher graft success rate [8].

Tympanoplasty, a common otology procedure, is highly successful in treating tympanic membrane perforations with a success rate of up to 95%, irrespective of chronic inflammation [9,10]. This procedure uses different incision methods, including retroauricular, endaural, and transcanal, for membrane reconstruction. Particularly for anterior quadrant perforations, many otologists prefer the retroauricular approach [11]. However, this method often necessitates a canalplasty [12,13]. The endaural approach is generally effective for posterior perforations, while the less invasive transcanal approach has limited applicability [13,14]. Modern surgery is increasingly utilizing minimally invasive methods. For example, endoscopy in COM surgery is emerging as a less invasive yet effective approach [15,16]. The endoscope not only provides a broader field of view but also eases visibility in areas that are challenging to observe under a microscope. For instance, it simplifies the control of anterior marginal perforations and visualization of hard-to-reach areas such as the attic, hypotympanum, sinus tympani, and facial recess [17].

Endoscopic tympanoplasty is a relatively newer procedure that has been gaining popularity in recent years [17]. Initially, the endoscope was primarily used for preliminary exploration and as an aid in microscopic ear surgeries. The adoption of the endoscope as a primary tool in such surgeries was first documented by Marchioni et al. in 2010 [1]. However, the long-term effectiveness and success rates of endoscopic ear surgeries are not fully established, leading to varying opinions regarding its primary use. Numerous studies have been conducted in recent years to measure the reliability and efficiency of the endoscopic approach in otologic surgery. Unfortunately, comprehensive comparisons and established evidence between traditional microscopic techniques and newer endoscopic tympanoplasty techniques are still lacking, particularly concerning auditory results, graft success, and complication rates [18].

This study directly compares the anatomical and functional outcomes of both microscopic and endoscopic tympanoplasty surgical procedures. The study's primary objective was to compare the functional and anatomical success rates between these groups, while the secondary objective was to examine any possible correlation between the size of a perforation and functional enhancement.

## Materials and methods

### Design and Study Population

The Institutional Clinical Research Ethics Committee approved this prospective randomized clinical trial (protocol number: 20.478.486). All methods were compliant with the 1964 Helsinki Declaration and its subsequent amendments. The study was initially intended to consist of 78 patients, as determined by a power analysis carried out using G*Power 3.1.9.7 software. This assumed a power of 95% and a significance level of $\alpha$=0.05 and was based on an effect size for an independent sample t-test. However, time constraints limited the study to 40 patients. Consequently, a revised power analysis was conducted, revealing a power of 70% based on the same effect size and the smaller sample size of 40.

Between December 2018 and January 2020, 40 adult patients who presented to the Otorhinolaryngology Clinic of Manisa Celal Bayar University Hafsa Sultan Hospital had tympanoplasty performed, either endoscopically or microscopically (20 patients each). To avoid selection bias, patients were selected in order of their presentation and alternately assigned to one of the two surgical approaches. Our study, as per the CONSORT guidelines, was therefore characterized as a parallel-design clinical trial with a 1:1 allocation ratio. Patients were simply randomized into groups, again following CONSORT guidance, by a single surgeon.

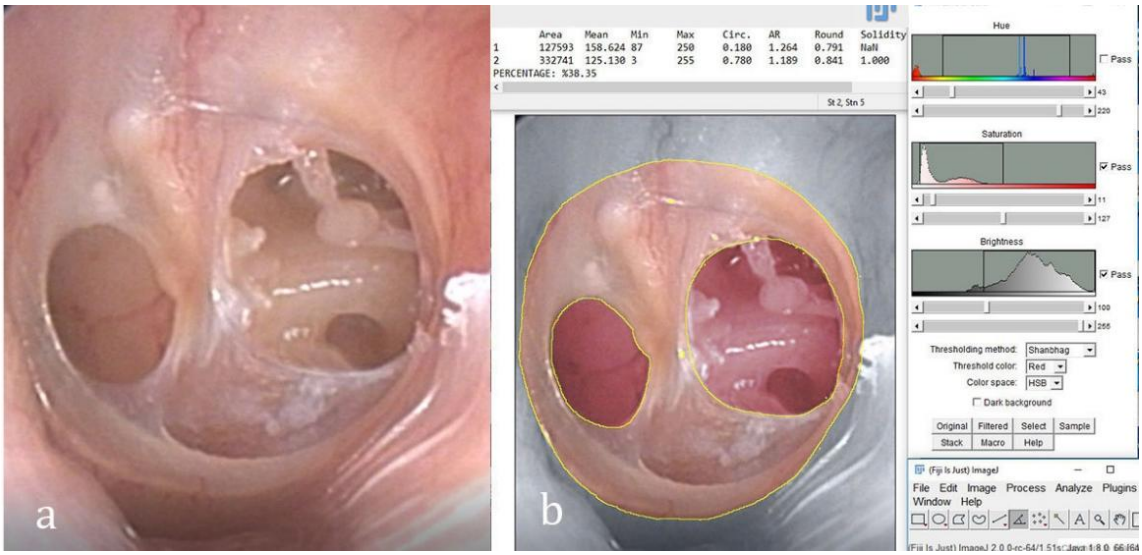
Pre-operative and 6-month post-operative pure tone audiometry examinations were performed on all patients. Exclusion criteria included the presence of a retraction pocket or cholesteatoma, ossicular chain damage, or previous surgery in the same ear. Pre-operative and 6-month post-operative endoscopic tympanic membrane examinations allowed us to record perforation size and location. There were no methodological changes relating to surgical technique or patient selection throughout the study.

### Surgical Technique

All patients underwent surgery in the hospital's general operating theater. A postauricular approach was used for microscopic Type-1 tympanoplasty in 20 patients, while transcranial endoscopic Type-1 tympanoplasty was performed on the remaining 20 patients. Both groups received a tragal perichondrial cartilage composite graft (Figure 1). General anesthesia was used in all procedures.

Figure 1: Tragal perichondrial cartilage composite graft, which was used in both groups.

Figure 2: Calculation of perforation size using ImageJ software.




### Functional and Anatomical Evaluation

Our study's functional evaluation was carried out at our institution's audio-vestibular unit, and the otoendoscopic recordings were taken from the recording room of the inpatient ward. For functional evaluation, the mean of the air conduction thresholds (ACT) and the bone conduction thresholds (BCT) at frequencies of 250, 500, 1000, 3000, and 4000 Hz were calculated from pre-operative and 3-month post-operative pure tone audiometry. The air bone gap (ABG) was calculated at the time of application and the 6-month post-operative audiometry. We calculated the air conduction gain (ACG) using the formula: $ACG=(ABG^{(pre\text{-}operative)} - ABG^{(post\text{-}operative)}$. The size of the tympanic membrane perforation as a percentage of the total area was measured using ImageJ software (Figure 2). Lastly, the integrity of the tympanic membrane and graft position were examined and recorded 6 months after the operation.

### Statistical Analysis

We compared ACG and post-operative ABG values for functional evaluations. Anatomical evaluations involved a comparison of pre- and post-operative otoendoscopic examination records. We used Shapiro-Wilk and Levene tests to analyze variance distribution and equality, respectively. Depending on the results of the Shapiro-Wilk test, we carried out inter-group data comparison using either an independent samples T-test or a one-way analysis of variance (ANOVA) test. Data are presented as mean (standard deviation [SD]), where a 95% confidence interval and $P<0.05$ are considered statistically significant (IBM SPSS Statistics Version 26).

## Results

### Descriptive Statistics

Our study comprised 40 patients, including 23 females and 17 males, with an average age of 36.20 (13.29), who received Type-1 tympanoplasty. Patients were randomly assigned to either endoscopic or microscopic surgery based on their presentation order, with ten in each group. We found no statistical difference in age between the groups ($P=0.221$), and the Mann-Whitney U test on gender distribution also indicated no significant discrepancy ($P=0.343$).

### Functional Results

The ACT, ABG, and ACG values for both groups exhibited a normal distribution ($P>0.05$ for each), suggesting no significant inter-group difference. Specifically, the pre-operative ACT values were 30.11 (5.19) and 28.45 (5.19) for the endoscopic and microscopic groups, respectively ($P=0.404$). The pre-operative ABG values were 24.58 (5.35) and 27.17 (6.34) for the endoscopic and microscopic groups, respectively, and they did not significantly differ ($P=0.169$). Post-operative ACT values were 17.09 (11.28) and 13.55 (7.99) for the endoscopic and microscopic groups, respectively, also revealing no significant difference ($P=0.258$). Similarly, post-operative ABG values, 13.97 (10.91) for the endoscopic group and 9.63 (7.83) for the microscopic group, showed no significant discrepancy ($P=0.156$) (Figure 3). Finally, the mean ACG values used to measure surgery's functional success were 13.08 (7.47) and 14.90 (5.04) for the endoscopic and microscopic groups, respectively, and these did not significantly differ ($P=0.395$) (Figure 4).

Figure 3: Comparative box-plot graph showing post-operative ABG values ($P=0.156$).

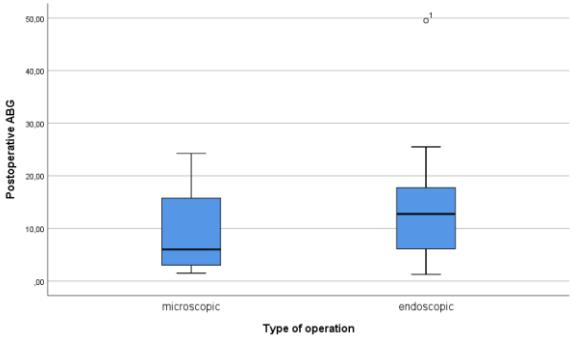
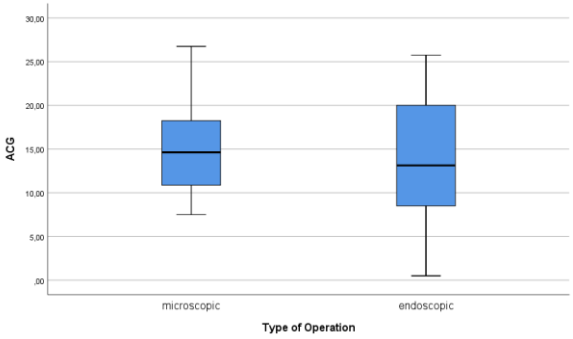



Figure 4: Comparative box-plot graph showing post-operative hearing ACG values by group ($P=0.395$).



**Anatomical Results**

Anatomical success, defined as the absence of perforation, retraction, and lateralization 6 months post-operation, was achieved in all 20 patients in the microscopic group and 90% of the patients in the endoscopic group. Using the Mann-Whitney U test, which is appropriate for ordinal variables, no significant differences were found in anatomical success between the two groups ($P$=0.317). The percentage of perforation size, calculated with ImageJ, was 45.05 (26) and 48.65 (25) in the endoscopic and microscopic groups, respectively. Again, no significant differences were noted ($P$=0.658). Furthermore, the Spearman correlation test revealed no significant association between perforation percentage and ACG ($P$=0.169, r=-0.222).

## Discussion

The current literature contains comparisons of endoscopic and microscopic tympanoplasty techniques regarding functional and anatomical success, but few randomized controlled trials exist [19-21]. Our study, being a prospective randomized controlled trial, should significantly contribute to this comparison. Our patients were alternately randomized to either endoscopic or microscopic surgeries based on their order of presentation. By including only Type-1 tympanoplasty cases, we enhanced the homogeneity of our groups, strengthening our study.

We assessed functional outcomes by calculating the ACG using the difference between post-operative and pre-operative ACT values. With this method, we detected no difference in post-operative functional gains between the two techniques. Pre-operative ABG values, indicating the level of conductive hearing loss, also showed no difference between the groups, further highlighting their homogeneity.

In terms of anatomical success, only two endoscopic group cases had post-operative perforations, a non-statistically significant finding. Furthermore, we innovatively used ImageJ software to calculate the perforation sizes, to our knowledge, the first usage of such methodology. However, we found no significant correlation between calculated perforation size and ACG. We conclude that the perforation size does not impact the final functional success in both groups.

The microscopic approach has traditionally been the norm for tympanic membrane reconstruction and hearing rehabilitation. Despite its widespread use, it presents drawbacks such as restricted visualization of the surgical area, long operation times, and scarring due to incisions [22-24]. Conversely, the endoscopic approach is increasingly preferred as it offers advantages over the microscopic method. Importantly, the transcranial approach prevents visible scar tissue and auricular deformity [25,26]. Research into surgical duration also indicates its superiority in this aspect.

Furthermore, the superior angular view provided by the otoendoscopic method is extremely beneficial for cases involving narrow external auditory canals [27]. A recent meta-analysis has also demonstrated its merits in terms of dysgeusia [18]. However, most studies comparing both techniques are retrospective and exhibit high clinical variability. Our study stands out because it solely focuses on Type-1 tympanoplasty cases. Shakya et al. [30] have also compared these techniques in Type-1 tympanoplasty cases, but their research is retrospective and may be subject to selection bias.

Certainly, the endoscopic method has its drawbacks. For instance, it can be challenging to apply in cases where patients have narrow or difficult-to-navigate external auditory canals. These conditions can impede visibility and the use of tools simultaneously. Likewise, managing bleeding can be problematic due to the difficulty of operating with one hand. Nevertheless, studies are available on methods to counter these challenges [31].

One drawback of our study is not being able to attain the intended number of cases within the project's timeframe. Consequently, the statistical power is slightly compromised. However, the forward-looking approach of our study and balanced randomization of cases between both groups effectively counteract selection bias.

While the microscopic method is traditionally used, it has limitations such as prolonged operation times and scarring. The endoscopic approach is becoming more popular due to its less scarring and suitability for narrow ear canals. This study's findings align with the existing literature, indicating no significant differences in post-operative functional gains between the two techniques. Both methods show similar efficacy in air conduction gains, and the size of tympanic membrane perforations, as measured by ImageJ software, does not seem to have a significant impact. The study implies that the endoscopic technique is functionally on par with the microscopic method, advocating for its wider use in otologic surgeries due to its operational benefits and comparable success rate.

**Conclusion**

This study indicates that the functional success of endoscopy in Type-1 tympanoplasty is comparable to the microscopic method. Its various advantages suggest an increased future popularity for the endoscopic method.

## References


1. Dündar R, Kulduk E, Soy FK, Aslan M, Hanci D, Muluk NB, et al. Endoscopic versus microscopic approach to type 1 tympanoplasty in children. Int J Pediatr Otorhinolaryngol. 2014 Jul;78(7):1084-9. doi: 10.1016/j.ijporl.2014.04.013.
2. Wullstein HL. Funktionelle operation in mittelohr mit hilfe des freien spaltlappen-transplantates. Arch Ohren Nasen Kehlkopfheilkd. 1952;161:422-35.
3. Zöllner F. The principles of plastic surgery of the sound-conducting apparatus. J Laryngol Otol. 1955 Oct;69(10):637-52.
4. Wullstein H. Theory and practice of tympanoplasty. Laryngoscope. 1956 Aug;66(8):1076-93. doi: 10.1288/00005537-195608000-00008.
5. Mudry A. History of myringoplasty and tympanoplasty type I. Otolaryngol Head Neck Surg. 2008;139:613–4.
6. Mutlu F, Durmuş K, Öztürk M, Değer HM. Comparison of anterior tab flap and underlay tympanoplasty techniques in anterior tympanic membrane perforations. J Surg Med. 2021 Sep. 1 [cited 2024 May 7];5(9):917-20.
7. Kirazli T, Bilgen C, Midilli R, Ogüt F. Hearing results after primary cartilage tympanoplasty with island technique. Otolaryngol Head Neck Surg. 2005 Jun;132(6):933-7. doi: 10.1016/j.otohns.2005.01.044.
8. Yang T, Wu Q, Peng Q, Zhang Y, Qie S, Sun H. Comparison of cartilage graft and fascia in type 1 tympanoplasty: systematic review and meta-analysis. Acta Otolaryngol. 2016;136(11):1085-90.
9. Nassif N, Berlucchi M, de Zinis LOR. Tympanic membrane perforation in children: endoscopic type I tympanoplasty, a newly technique, is it worthwhile? Int J Pediatr Otorhinolaryngol. 2015;79(11):1860-4.
10. Tan HE, Santa Maria PL, Eikelboom RH, Anandacoomaraswamy KS, Atlas MD. Type i tympanoplasty meta-analysis: a single variable analysis. Otol Neurotol. 2016;37(7):838-46.
11. Coskun BU, Cinar U, Seven H, Ugur S. The effects of the incision types in myringoplasty operations on cosmetics. Eur Arch Otorhinolaryngol. 2006;263:820-2.
12. Kessler A, Potsic WP, Marsh RR. Type I tympanoplasty in children. Arch Otolaryngolog Head Neck Surg. 1994;120:487-90.
13. Jako GJ. Postaural versus endaural exposure in tympanoplasty. Laryngoscope. 1967;77:2022-31.

14. Halim A, Borgstein J. Pediatric myringoplasty: postaural versus transmeatal approach. Int J Pediatric Otorhinolaryngol. 2009;73:1580-3.
15. Tarabichi M. Endoscopic management of acquired cholesteatoma. Am J Otol. 1997;18:544-9.
16. Kakehata S, Watanabe T, Ito T, Kubota T, Furukawa T. Extension of indications for transcanal endoscopic ear surgery using an ultrasonic bone curette for cholesteatomas. Otol Neurotol. 2014;35:101-7.
17. Patil RN. Endoscopic tympanoplasty-Definitely advantageous. Asian J Ear Nose Throat. 2003;25:9-13.
18. Gkrinia E, Ntziovara AM, Brotis AG, Tzimkas-Dakis K, Saratziotis A, Korais C, et al. Endoscopic Versus Microscopic Tympanoplasty: A Systematic Review and Metanalysis. Laryngoscope. 2024 Feb 28. doi: 10.1002/lary.31365. Epub ahead of print.
19. Raj A, Mejer R. Endoscopic Transcanal myringoplasty—a study. Indian J Otolaryngol Head Neck Surgery. 2001;53(1):47-9.
20. Harugop AS, Mudhol RS, Godhi RA. A comparative study of endoscope assisted myringoplasty and microscope assisted myringoplasty. Indian J Otolaryngol Head Neck Surg. 2008;60(4):298-302.
21. Lade H, Choudhary SR, Vashishth A. Endoscopic vs microscopic myringoplasty: a different perspective. Eur Arch Otorhinolaryngol. 2014;271(7):1897-902.
22. Kaftan H, Noack M, Friedrich N, Völzke H, Hosemann W. Prävalenz chronischer Trommelfellperforationen in der Erwachsenen Bevölkerung. HNO. 2008;56(2):145-50.
23. Ayache S. Cartilaginous myringoplasty: The endoscopic transcanal procedure. Eur Arch Otorhinolaryngol. 2013;270(3):853-60.
24. Pap I, Tóth I, Gede N, Hegyi P, Szakács Z, Koukkoullis A, et al. Endoscopic type I tympanoplasty is as effective as microscopic type I tympanoplasty but less invasive-A meta-analysis. Clin Otolaryngol. 2019 Nov;44(6):942-53. doi: 10.1111/coa.13407.
25. Gülsen S, Arici M. Endoscopic transcanal versus conventional microscopic tympanoplasty in treatment of anterior tympanic membrane perforations. Eur Arch Otorhinolaryngol. 2019;276(12):3327-33.
26. Gülsen S, Baltaci A. Comparison of endoscopic transcanal and microscopic approach in type 1 tympanoplasty. Braz J Otorhinolaryngol. 2021;87(2):157-63.
27. Bennett ML, Zhang D, Labadie RF, Noble JH. Comparison of middle ear visualization with endoscopy and microscopy. Otol Neurotol. 2016;37(4):362-6.
28. Manna S, Kaul VF, Gray ML, Wanna GB. Endoscopic versus microscopic middle ear surgery: a meta-analysis of outcomes following tympanoplasty and stapes surgery. Otol Neurotol. 2019;40(8):983-93.
29. Tseng CC, Lai MT, Wu CC, Yuan SP, Ding YF. Comparison of the efficacy of endoscopic tympanoplasty and microscopic tympanoplasty: a systematic review and meta-analysis. Laryngoscope. 2017;127(8):1890-6.
30. Shakya D, Arun KC, Nepal A. A comparative study of endoscopic versus microscopic cartilage type I tympanoplasty. Int Arch Otorhinolaryngol. 2020;24(1):E80-5.
31. Anschuetz L, Bonali M, Guarino P, Fabbri FB, Alicandri-Ciufelli M, Villari D, et al. Management of Bleeding in Exclusive Endoscopic Ear Surgery: Pilot Clinical Experience. Otolaryngol Head Neck Surg. 2017 Oct;157(4):700-6. doi: 10.1177/0194599817726982.

J Surg Med. 2025;9(2):23-26.
https://doi.org/10.28982/josam.8013

JOSAM

Journal of Surgery and Medicine

e-ISSN: 2602-2079

Research article
https://jsurgmed.com/

# A comparison between emergency physicians and radiologists on the interpretation of computed tomography in acute appendicitis

**Yi-Hsiang Pan [1], Tsung-Hsi Wang [2,3], Hui-An Lin [1,4], Sheng-Feng Lin [1,5,6,7,8], Enoch Kang [9], Chun-Chieh Chao [1,4,10], Peter C. Hou [11]**

[1] Department of Emergency Medicine, Taipei Medical University Hospital, Taipei, Taiwan
[2] Director of Planning Division, National Health Insurance Administration, Ministry of Health and Welfare, Taiwan
[3] Associate Professor, Department of Public Health, School of Medicine, National Yang Ming Chiao Tung University, Taiwan
[4] Graduate Institute of Injury Prevention and Control, College of Public Health, Taipei Medical University, Taipei, Taiwan
[5] School of Public Health, College of Public Health, Taipei Medical University, Taipei City, Taiwan
[6] Department of Public Health, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan
[7] Department of Clinical Pathology, Taipei Medical University Hospital, Taipei, Taiwan
[8] Institute of Health Policy and Management, College of Public Health, National Taiwan University, Taipei, Taiwan
[9] Institute of Health Policy & Management, College of Public Health, National Taiwan University, Taipei, Taiwan
[10] Department of Emergency Medicine, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan
[11] Department of Emergency Medicine, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan

**ORCID of the author(s)**

YHP: https://orcid.org/0000-0002-1435-5529
THW: https://orcid.org/0000-0003-1948-9849
HAL: https://orcid.org/0000-0002-0661-173X
SFL: https://orcid.org/0000-0003-0470-2184
EK: https://orcid.org/0000-0002-4903-942X
CCC: https://orcid.org/0000-0001-5527-690X
PCH: https://orcid.org/0000-0002-7726-2901

**Corresponding Author**
Chun-Chieh Chao
252 Wuxing Street, Taipei, Taiwan
Department of Emergency Medicine, Taipei Medical University Hospital, Taipei, Taiwan
E-mail: chaosees@gmail.com

**Ethics Committee Approval**
This study was approved by IRB of Taipei Medical University and the approval number was listed as N201906023 (TMUH number N201909009). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

**Conflict of Interest**
No conflict of interest was declared by the authors.

**Financial Disclosure**
The authors declared that this study has received no financial support.

**Published**
2025 February 12



## Abstract

**Background/Aim:** Appendicitis is a common acute abdominal disease seen in the emergency department (ED). Early diagnosis of appendicitis can reduce time to treatment and prevent complications. In this study, we aimed to compare the interpretation of computer tomography (CT) scans between emergency physicians and radiologists.

**Methods:** We conducted a retrospective cohort study that enrolled patients with CT scans for suspected acute appendicitis in an academic hospital from July 2019 to May 2020. Analysis of the accuracy of the diagnosis of appendicitis and time from completion of CT scan were compared between emergency physicians and radiologists.

**Results:** A total of 318 patients with appendicitis were included. Patients arriving at the hospital during off-hours were younger (mean difference: 5, $P$=0.016) and more commonly had normal C-reactive protein (chi-square: 11.19, $P$<0.001). Neither group's interpretation of appendicitis was affected by arrival time, and both groups performed differential diagnosis well (emergency physician area under curve [AUC]: 0.912 vs. radiologist AUC: 0.911). Time to CT interpretation by emergency physicians was significantly lower than by radiologists (mean difference: -217.37 min, $P$<0.001).

**Conclusions:** The interpretation of abdominal CT scans for acute appendicitis by emergency physicians was more efficient and equally accurate compared to interpretation by radiologists.

**Keywords:** appendicitis, computed tomography, emergency physicians, radiologists

How to cite: Pan YH, Wang TH, Lin HA, Lin SF, Kang E, Chao CC, Hou PC. A comparison between emergency physicians and radiologists on the interpretation of computed tomography in acute appendicitis. J Surg Med. 2025;9(2):23-26.

## Introduction

Appendicitis is a common acute abdominal disease seen in the emergency department (ED), and the estimated lifetime risk is around 7–8% [1]. Appendicitis can occur at any age, though it is most common in patients between 10 and 30 years old [2]. Obstruction of vermiform appendix, often by a fecalith, is the classic etiology of appendicitis. Other causes may include obstruction by tumor, gallstone, lymphoid hyperplasia, or parasitic infection [3]. Appendicitis is suspected in patients presenting with acute right lower quadrant pain and leukocytosis. The final diagnosis depends on histologic findings of the surgical specimen. There are several diagnostic image exams for appendicitis, including transabdominal ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI). CT with contrast is frequently used for diagnosis in the ED. CT is used in 86% of patients in the USA, and the sensitivity and positive predictive value of CT can reach 96% [4,5]. In many countries, the standard treatment for appendicitis is appendectomy, which requires immediate surgical consultation [6]. A meta-analysis of 11 non-randomized studies showed that delaying appendectomy for more than 48 hours was associated with increased surgical site infections and other adverse events, and that prompt appendectomy provided the fastest resolution of patients' pain [7]. Several studies have compared the CT time of interpretation of appendicitis between emergency physicians and radiologists [8,9]. The aim of this study was to compare the time to CT scan and the accuracy of CT scan interpretation between emergency physicians and radiologists.

## Materials and methods

This retrospective study was performed in the ED of a 750-bed tertiary referral and academic hospital in northern Taiwan, which handles approximately 52,000 ED visits annually. A preliminary report system for emergency physicians to document CT scan interpretations was established in June 2019. The reason for creating this system was to allow emergency physicians to receive a 20% bonus payment from the national health insurance if a preliminary report was documented within 2 hours of the completion of the CT scan. In the study, we reviewed all CT scans conducted from July 2019 to May 2020, and we recorded the report time for CT related to suspicion of appendicitis. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were used during case enrolment. Report time was defined as the interval from the CT being ordered to the report being documented, and report times were recorded separately for the preliminary report system of emergency physicians and the final report of the radiologists. In the study's hospital setting, emergency physicians and radiologists read CT scans and make preliminary and final reports independently. Final diagnosis of appendicitis was determined by the pathologic report of the surgical procedure. We also collected clinical information such as sex, fever, white blood cell (WBC) count, and C-reactive protein (CRP). The definition of weekday hours was 08:00–17:00 from Monday to Friday, except for holidays; off-time hours were defined as weeknights (17:00–08:00 the next day) and weekend hours.

This study was approved by the IRB, approval number N201906023 (TMUH number N201909009).

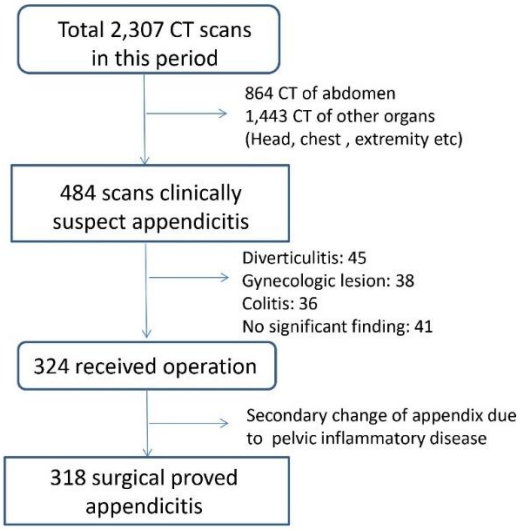
**Statistical analysis**

All statistical analyses were conducted using SPSS Statistics version 24 for Windows (IBM Corp., Armonk, New York, USA). To analyze the association between ED arrival time (i.e., weekday hours vs. off-time hours) and characteristics, chi-square test was applied to dichotomous variables such as patient sex, fever, WBC count, and CRP level, as well as appendicitis judgment. Due to the imbalanced data on the interpretations of appendicitis (i.e., very few cases without appendicitis), precision-recall curves-based area under curve (AUC) were used to test the appropriateness of the interpretations of appendicitis by emergency physicians and radiologists. To examine the difference in review time and age between the two specialties, data were analyzed using the Wilcoxon test due to non-normal distribution. Medians with interquartile range (IQR) of review time were reported for each group, and between-group mean differences were also presented with the *P*-value of the Wilcoxon test.

## Results

A total of 2,307 abdominal CT scans were performed during the study period, including 484 cases with initial clinical suspicion of appendicitis. A total of 318 patients with appendicitis were enrolled according to surgical findings (Figure 1).

Figure 1: The algorithm for enrollment of the subjects.




With regard to patient characteristics, sex, fever, and abnormal WBC count did not vary in ED arrival time (Table 1). However, patients who presented to the ED during off-time hours were younger than those arriving during weekday hours (mean difference [MD]: 5; *P*=0.016). Moreover, patients reporting to the ED during off-time hours more commonly had normal CRP than those who reported during weekday hours (chi-square: 11.19; *P*<0.001). For both emergency physicians and radiologists, the accuracy of interpretation of appendicitis was not affected by arrival time. Based on surgical findings, both emergency physicians (AUC: 0.912) and radiologists (AUC: 0.911) were accurate in diagnosis of appendicitis.

On the other hand, report time of appendicitis was significantly different between emergency physicians and radiologists. On average, the report time among emergency

physicians was significantly lower than among radiologists (MD: -217.37 min; $P$<0.001) (Figure 2). This phenomenon did not vary by patient ED arrival time, fever, abnormal WBC count, or abnormal CRP (Table 2).

Table 1: Characteristics of patients with appendicitis (n=318)

| | | Arrival time | | | |
|---|---|---|---|---|---|
| **Characteristic** | **Total [a]** | **Off-time** | **Weekday hours** | **Diff** | ***P*-value** |
| **Sex (patient)** | | | | 2.50 | 0.114 |
| Female | 166 (52.2%) | 110 (49.1%) | 56 (59.6%) | | |
| Male | 152 (47.8%) | 114 (50.9%) | 38 (40.4%) | | |
| **Age** | 42.07±17.50 | 40.71±17.02 | 45.30±18.28 | -5.00 | 0.016 |
| **Fever** | | | | 0 | 1.000 |
| Yes | 42 (13.2%) | 30 (13.4%) | 12 (12.8%) | | |
| No | 276 (86.8%) | 194 (86.6%) | 82 (87.2%) | | |
| **WBC** | | | | 2.75 | 0.097 |
| Abnormal | 238 (74.8%) | 174 (77.7%) | 64 (68.1%) | | |
| Normal | 80 (25.2%) | 50 (22.3%) | 30 (31.9%) | | |
| **CRP** | | | | 11.19 | <0.001 |
| Abnormal | 212 (66.6%) | 136 (60.7%) | 76 (80.9%) | | |
| Normal | 106 (33.3%) | 88 (39.3%) | 18 (19.1%) | | |
| **Emergency** | | | | -- | -- |
| Appendicitis | 318 (100%) | 224 (100%) | 94 (100%) | | |
| No appendicitis | 0 (0%) | 0 (0%) | 0 (0%) | | |
| **Radiology** | | | | 0.02 | 0.887 |
| Appendicitis | 316 (99.4%) | 222 (99.1%) | 94 (100%) | | |
| No appendicitis | 2 (0.6%) | 2 (0.9%) | 0 (0%) | | |

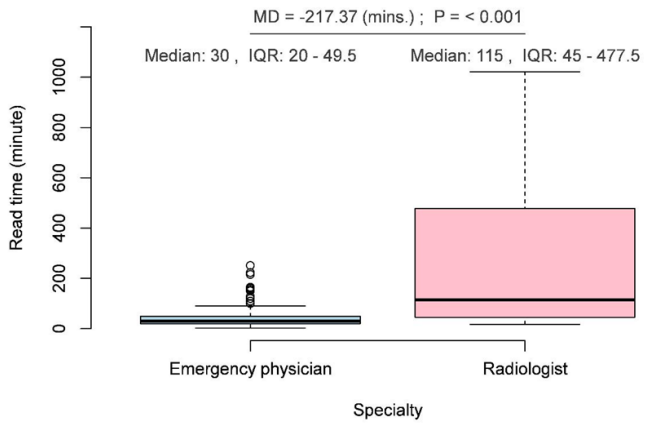
[a] number (percentage), Diff: Difference, CRP: C-Reactive protein, WBC: white blood cell. Chi-square was used to test categorical variable and student's t test for continuous variable.

Table 2: Subgroup analysis of review time (minutes) of appendicitis

| | Emergency physician | | Radiologist | | | |
|---|---|---|---|---|---|---|
| **Subgroup** | **Median** | **IQR** | **Median** | **IQR** | **Diff** | ***P*-value** |
| **Time of reporting** | | | | | | |
| Weekday hours | 33.00 | 20.00-76.50 | 70.00 | 41.50-142.50 | -71.89 | <0.001 |
| Off-time | 30.00 | 20.00-49.50 | 352.00 | 45.50-631.00 | -313.07 | <0.001 |
| **Fever** | | | | | | |
| Yes | 23.00 | 20.00-33.00 | 89 | 36.00-390.00 | -196.67 | <0.001 |
| No | 31.00 | 20.00- 50.00 | 120.00 | 46.25-478.75 | -220.52 | <0.001 |
| **WBC** | | | | | | |
| Abnormal | 32.00 | 20.00-50.00 | 138.00 | 45.00- 559.50 | -235.50 | <0.001 |
| Normal | 23.00 | 16.75- 47.5 | 91.00 | 44.50-350.50 | -163.43 | <0.001 |
| **CRP** | | | | | | |
| Abnormal | 30.00 | 20.00-45.75 | 94.50 | 45.25-397.50 | -194.45 | <0.001 |
| Normal | 31.00 | 21.00- 60.00 | 150.00 | 45.00- 570.00 | -263.21 | <0.001 |

Wilcoxon test, CRP: C-Reactive protein, IQR: interquartile range, Diff: Difference, MD: mean difference, WBC: white blood cell

Figure 2: Boxplot of review time of appendicitis between emergency physician and radiologist.




## Discussion

Acute appendicitis is a common atraumatic surgical emergency in the ED [10]. Abdominal CT scan is a diagnostic tool to detect acute appendicitis, and timely and accurate interpretation of the CT scan can provide patients with optimal treatment. We investigated and compared the accuracy and the time of interpretation of abdominal CT scan for acute appendicitis between emergency physicians and radiologists in a Taiwanese cohort. Diagnosis with CT and surgical treatment is standard treatment for appendicitis in Taiwan [11]. We also analyzed the results of different admission times and patient characteristics. One of the most crucial findings in this study is that the emergency physicians and radiologists showed similar accuracy but that the emergency physicians had shorter report times.

Several previous studies have compared the difference between radiologists and clinical physicians in CT scan results [8,9,12,13]. In our study of 318 cases, emergency physicians and radiologists showed similar accuracy results (AUC: 0.912 vs. 0.911). The slightly higher accuracy in emergency physicians may be due to the clinical approach with patients, involving history taking, physical examination, and real-time consultation with radiologists as needed. This result suggests that emergency physicians' interpretation of abdominal CT scan for acute appendicitis can be reliable. One study in the USA found that overcrowding in the ED is associated with an approximately 2-hour delay to CT interpretation by radiologists [14]. This delay may increase the length of stay for the patients, which can cause a vicious circle and increase the care burden for the staff. It can also delay the time to operation and ultimately increase morbidity or mortality. In our study, the overall mean deviation time between the two groups was 217 min from triage to CT interpretation. The overall median time for emergency physicians was 30 min, compared to 115 for radiologists. This difference may be due to the fact that radiologists have many reports that need to be documented at the same time, whereas emergency physicians are normally informed once the CT is done, allowing them to interpret the result in a timely fashion. The other reason is that patients' treatment and disposition depend on the CT result, so emergency physicians will have more motivation and time pressure to give an initial report. To differentiate the time difference in diagnosis, the mean deviation times during weekday hours and off-time hours were 72 min and 313 min, respectively. During weekday hours, the median times were 33 min for emergency physicians and 70 min for radiologists; during off-time hours, the times were 30 min for emergency physicians and 352 min for radiologists. We found no difference for emergency physicians between weekday hours and off-time hours because they are on duty and responsible throughout their 12-hour shifts. By contrast, the hospital where the study took place had six board-certified radiologists on duty during weekday hours for CT interpretations but only one radiologist on duty during off-time hours for emergency procedures and reports. This explains the significant increase in median times during off-time hours in the radiologists group. If emergency physicians can precisely and quickly interpret CT results for acute appendicitis and seek the opinions of radiologists as needed, it can decrease patients' wait times and observation times, thereby easing the care burden for staff and decreasing overcrowding in the ED.

### Limitations

One limitation of our study is the potential for selection bias due to its retrospective design and reliance on data from a single center. This may limit the generalizability of our findings to broader patient populations or healthcare settings. Additionally, the retrospective nature of the study may have introduced inherent biases in data collection and interpretation. Moreover, while efforts were made to control for various confounding variables, the possibility of residual confounding cannot be completely ruled out. Factors not accounted for in our

analysis may have influenced the observed associations between arrival time and diagnostic outcomes.

Finally, the analysis of report times was limited to appendicitis cases, and factors influencing report times for other conditions were not investigated. Understanding these factors could provide a more comprehensive perspective on the efficiency of radiological reporting in the ED.

**Future research**

Further investigations are warranted to explore the factors contributing to the observed differences in report times and to develop strategies aimed at optimizing radiological reporting efficiency without compromising diagnostic accuracy.

**Conclusion**

The accuracy of interpreting CT scans for appendicitis by both emergency physicians and radiologists remained consistent irrespective of arrival time, demonstrating consistently high diagnostic precision. Implementation of protocols or interventions aimed at reducing reporting disparities could lead to improved patient outcomes and resource utilization in the management of acute abdominal conditions.

## References


1. Stewart BWKP, Khanduri P, McCord C, Ohene-Yeboah M, Uranues S, Vega Rivera F, et al. Global disease burden of conditions requiring emergency surgery. J Br Surg. 2014;101(1):e9-22.
2. Lowry SF, Davidov T, Shiroff AM. Appendicitis and appendiceal abscess. In: Fischer's Mastery of Surgery. 6th ed. Wolters Kluwer Health Adis (ESP); 2012.
3. Perez KS, Allen SR. Complicated appendicitis and considerations for interval appendectomy. Jaapa. 2018;31(9):35-41.
4. Florence M, Flum DR, Jurkovich GJ, Lin P, Steele SR, Symons RG, et al. Negative appendectomy and imaging accuracy in the Washington state surgical care and outcomes assessment program. Ann Surg. 2008;248(4):557-63.
5. Bendeck SE, Nino-Murcia M, Berry GJ, Jeffrey RB Jr. Imaging for suspected appendicitis: negative appendectomy and perforation rates. Radiology. 2002;225(1):131-6.
6. Baird DL, Simillis C, Kontovounisios C, Rasheed S, Tekkis PP. Acute appendicitis. BMJ. 2017;357.
7. Bhangu A. Safety of short, in-hospital delays before surgery for acute appendicitis: multicentre cohort study, systematic review, and meta-analysis. Ann Surg. 2014;259(5):894-903.
8. Dolatabadi AA, Baratloo A, Rouhipour A, Abdalvand A, Hatamabadi H, Forouzanfar M, et al. Interpretation of computed tomography of the head: emergency physicians versus radiologists. Trauma Mon. 2013;18(2):86.
9. Bagheri-Hariri S, Ayoobi-Yazdi N, Afkar M, Farahmand S, Arbab M, Shahlafar N, et al. Abdominal and pelvic CT scan interpretation of emergency medicine physicians compared with radiologists' report and its impact on patients' outcome. Emerg Radiol. 2017;24:675-80.
10. Chanana L, Jegaraj MA, Kalyaniwala K, Yadav B, Abilash K. Clinical profile of non-traumatic acute abdominal pain presenting to an adult emergency department. J Fam Med Prim Care. 2015;4(3):422-5.
11. Ho TL, Muo CH, Shen WC, Kao CH. Changing roles of computed tomography in diagnosing acute appendicitis in emergency rooms. QJM. 2015;108(8):625-31.
12. Kartal ZA, Kozacı N, Çekiç B, Beydilli İ, Akçimen M, Güven DS, et al. CT interpretations in multiply injured patients: comparison of emergency physicians and on-call radiologists. Am J Emerg Med. 2016;34(12):2331-5.
13. Kang MJ, Sim MS, Shin TG, Jo IJ, Song HG, Song KJ, et al. Evaluating the accuracy of emergency medicine resident interpretations of abdominal CTs in patients with non-traumatic abdominal pain. J Korean Med Sci. 2012;27(10):1255.
14. Mills AM, Baumann BM, Chen EH, Zhang KY, Glaspey LJ, Hollander JE, et al. The impact of crowding on time until abdominal CT interpretation in emergency department patients with acute abdominal pain. Postgrad Med. 2010;122(1):75-81.

J Surg Med. 2025;9(2):27-29.
https://doi.org/10.28982/josam.7976

JOSAM

Journal of Surgery and Medicine

e-ISSN: 2602-2079

Case report
https://jsurgmed.com/

# Fournier gangrene in a puerperal woman: An unusual presentation

**Necati Hançerlioğulları [1], Esin Merve Koç [1], Selen Yaman [1], Yeliz Çolakoğlu [1], Berkcan Demir [2], Ahmet Şimşek [2]**

[1] Ankara City Hospital, Department of Obstetrics and Gynecology, Ankara, Turkey
[2] Ankara City Hospital, Department of General Surgery, Ankara, Turkey

**ORCID of the author(s)**

NH: https://orcid.org/0000-0002-5744-7992
EMK: https://orcid.org/0000-0001-7686-9149
SY: https://orcid.org/0000-0001-5247-6615
YÇ: https://orcid.org/0000-0001-7987-1260
BD: https://orcid.org/0009-0000-1809-9780
AŞ: https://orcid.org/0000-0001-7936-4840

**Corresponding Author**
Necati Hançerlioğulları
Department of Obstetrics and Gynecology, Ankara Bilkent City Hospital, 06600 Ankara, Turkey
E-mail: necatihancerliogullari@gmail.com

**Informed Consent**
The authors stated that the written consent was obtained from the patient presented with images in the study.

**Conflict of Interest**
No conflict of interest was declared by the authors.

**Financial Disclosure**
The authors declared that this study has received no financial support.

**Published**
2025 February 19



## Abstract

Fournier's gangrene (FG) is a localized form of necrotizing fasciitis that originates in the perineum and external genitalia. Its incidence is low, at 1.6 per 100,000, contributing to less than 0.02% of hospitalizations, and it is particularly rare in women. This report focuses on a case of FG in a 34-year-old woman who had recently undergone a cesarean delivery. The patient, a second-time mother with one previous birth, arrived at our hospital complaining of hip pain during her full-term pregnancy. Post-delivery, she was diagnosed with FG. Her most likely risk factor was a prior anal fissure and home-applied herbal therapy to the affected area. It is important to keep in mind that FG should be considered if an abscess develops in the urogenital region. FG is a potentially fatal infection that necessitates immediate diagnosis and treatment. Its effective management typically includes frequent and thorough debridement, broad-spectrum antibiotics, and diligent wound care.

**Keywords:** anal fissure, Fournier gangrene, infections, wound therapy, vacuum-assisted closure

## Introduction

Fournier's gangrene (FG) is a condition involving a skin, fascia, and subcutaneous tissue infection. Contributing risk factors include prior surgical procedures, diabetes mellitus, intravenous drug use, physical trauma, chronic illnesses, and alcohol abuse [1].

The initial infection begins in the genitourinary system and can spread rapidly. If not addressed, it can lead to toxic shock syndrome, sepsis, and multi-organ failure. Diagnosis techniques include clinical examination, imaging methods to detect gas in soft tissue, and tissue culture. Therapies for treatment include surgical debridement, broad-spectrum antibiotics, and vacuum-assisted closure therapy [2].

The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) is a scoring system utilized to determine the prognosis after diagnosing this condition. The system, first introduced by Wong C and his team [3], signifies a high risk of necrotizing fasciitis when the score reaches 6 or more. The assessment involves six factors: leukocyte count, hemoglobin and sodium levels, glucose and serum creatinine measures, and C-reactive protein value. As indicated by a study conducted by Kincius et al. [4], a LRINEC score above 5 can potentially be fatal. This report aims to document a case of necrotizing fasciitis in a 34-year-old woman post-cesarean delivery.

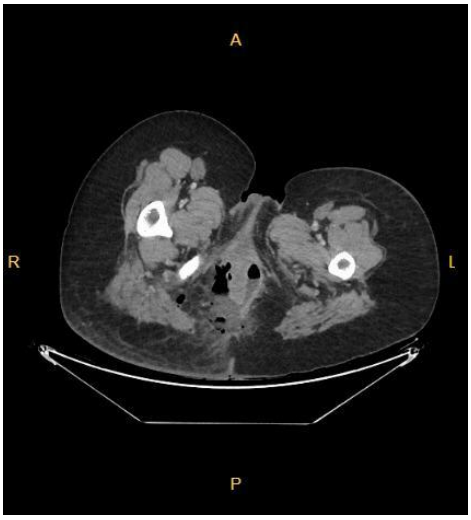
How to cite: Hançerlioğulları N, Koç EM, Yaman S, Çolakoğlu Y, Demir B, Şimşek A. Fournier gangrene in a puerperal woman: An unusual presentation. J Surg Med. 2025;9(2):27-29.

## Case presentation

A 34-year-old woman, who had previously given birth via cesarean section and was pregnant for the second time, attended our emergency department. She complained of hip pain and vaginal leakage. Given her history of cesarean section and membrane rupture, another cesarean section was performed. A necrotic skin area was identified in the right gluteal region 12 h post-operation, accompanied by severe infection, discharge, and a sizeable, hardened abscess (Figure 1). A computerized tomography (CT) scan was carried out on her abdomen, and a diagnosis of FG was made (Figure 2).

Figure 1: The gluteal region at the 12th hour postoperation, when symptoms first begin.

Figure 2: CT scan image showing gas bubbles in the perianal soft tissue




Air values were observed in the subcutaneous soft tissue in the perineal region, in both ischioanal fossae and in the right gluteal region, and diffuse heterogeneity was observed in the subcutaneous adipose tissue. Also, fluid collection was noted in the perineum at the 3–9 o'clock position, compatible with an abscess. Heterogeneity was observed in the perirectal fat tissue. The mesorectal fascia was thick. The bone structures in the section looked natural.

The LRINEC score that is used for The patient's LRINEC prognosis score stands at 8. The leukocyte count is 22 × $10^3$/$mm^3$, and the C-reactive protein (CRP) measurement is 188 mg/dL. The infection consultant recommended that the patient receive piperacillin+tazobactam at 4 × 4.5 g intravenously and teicoplanin at 1600 mg intravenously every 12 h. A culture from the wound site showed growth of Enterobacter cloacae.

The patient was transferred to the general surgery department, where she was sedated and her abscess was drained. No connection to the rectum was discovered during a rectal tap. The wound was regularly debrided and re-dressed every other day in surgery. On non-surgical days, dressing changes were carried out at the patient's bedside (Figure 3). Upon further investigation into her medical history, it was revealed that she had applied a stinging nettle solution to her anal region a week prior due to a long-term anal fissure.

The patient's infectious process subsided, prompting the application of a vacuum-assisted closure (VAC) to the wound area. VAC replacements occurred every 2 to 3 days, with continuous monitoring of the wound. Despite the patient's FG's proximity to the perianal region, a colostomy was not performed due to the patient's young age. Instead, frequent wound dressing changes and close monitoring were employed. As the VAC treatment proceeded, granulation tissue developed at the wound site. The wound's size gradually decreased until it was able to be secondarily sutured (Figure 4). The wound eventually completely healed and the patient was discharged. Consent for publishing the patient's images was properly obtained both verbally and in written form.

Figure 3: Debridement and vacuum-assisted closure application every other day in the general surgery service

Figure 4: After debridement, vacuum-assisted closure application and suture application

## Discussion

The mortality rate for FG is 8.3%. Factors such as a high body mass index, abnormal leukocyte, CRP and platelet counts, as well as impaired renal function, are determinants of infection severity [5]. A study indicated that a poor prognosis is likely due to elevated urea levels, along with low albumin and hematocrit levels [6]. Similarly, in our case, we observed high CRP levels together with low albumin and hematocrit levels.

Fournier gangrene is typically observed in individuals over the age of 50, yet research suggests that advanced age is not a direct contributing factor to the disease [7]. The condition is more common in men, with a reported male-to-female incidence ratio of 5.3:1 [8]. This is attributed to more effective secretion drainage in the female pelvic region. However, the absence of colles' fascia on a woman's anterior wall can lead to severe spread to the anterior abdominal wall. Thankfully, our patient is young and shows no signs of abdominal wall involvement.

The spread of infection locally is crucial in the disease's pathogenesis. Uncommon in the normal flora of the anogenital region, anaerobic bacteria are often found in wound cultures, along with Gram-negative and Gram-positive pathogens. Frequent pathogens include *Escherichia coli*, *Enterococcus faecium*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* [9]. In our patient's case, the present bacteria was Enterobacter cloacae. A multiple antibiotic regime is typically recommended, including third-generation cephalosporins, 5-nitroimidazole derivative antibiotics, and aminoglycoside [8]. We advised our patient to commence treatment of piperacillin, Tazobactam (4 × 4.5 g iv), and teicoplanin (1600 mg iv), administered every 12 h initially for the first three doses. These therapies are given empirically and should be adjusted based on culture and antibiogram reports. The regulation of blood sugar in diabetes mellitus (DM) is linked with disease progression, so particular attention needs to be paid to predisposing conditions such as DM and kidney failure. Our patient did not have diabetes or other systemic diseases. The most likely risk factor for our patient was a history of anal fissure and herbal therapy applied to that region by the patient.

Early diagnosis is crucial for effectively treating FG. The differential diagnosis can sometimes be challenging, as the infection progresses at a rate of up to 2–3 cm/h and is linked to a high mortality rate. Septicemia can develop within 1 h of disease onset. Early diagnosis depends on evaluating clinical signs, radiological findings, and laboratory analyses. A lack of gas image in the soft tissue during an ultrasound examination does not categorically exclude FG as a diagnosis. In our case, a CT scan was performed immediately as the patient's symptoms emerged, which was pivotal for diagnosis.

In doubtful cases, it is recommended to adopt an aggressive surgical procedure due to the invasive infection's tendency to spread through the fascial planes. The purpose of the surgical intervention is to effectively drain the infection and eliminate any necrotic tissue. However, the debridement should not stop at the normal skin surface but instead continue until a healthy fascia tissue layer is exposed. In the case described, General Surgeons implemented VAC for effective drainage and wound care. The wound was debrided and freshly dressed on alternate days, whereas the VAC was replaced every 2–3 days.

The use of fecal diversion is currently a controversial topic. Despite the patient's FG being situated near the perianal area, a colostomy was not carried out due to her young age. Instead, we adopted a comprehensive follow-up approach that included frequent wound dressings. Through regular patient monitoring and the application of VAC, granulation tissue developed at the wound site, leading to wound regression. Subsequently, the wound was sutured. In our case, care was taken to meticulously execute all surgical procedures.

**Conclusions**

FG is a serious infectious disease requiring swift diagnosis and aggressive surgical treatment. High-risk patients should be diagnosed through clinical evaluation, imaging, and LRINEC score. The treatment involves aggressive surgical debridement, usage of broad-spectrum antibiotics, careful wound care, and wound closure procedures.

## References


1. Sorensen MD, Krieger JN, Rivara FP, Broghammer JA, Klein MB, Mack CD, et al. Fournier's gangrene: population based epidemiology and outcomes. J Urol. 2009 May;181(5):2120-6. doi: 10.1016/j.juro.2009.01.034.
2. El-Qushayri AE, Khalaf KM, Dahy A, Mahmoud AR, Benmelouka AY, Ghozy S, et al. Fournier's gangrene mortality: a 17-year systematic review and meta-analysis. Int J Infect Dis. 2020 Mar;92:218-225. doi: 10.1016/j.ijid.2019.12.030.
3. Wong CH, Khin LW, Heng KS, Tan KC, Low CO. The LRINEC (laboratory risk indicator for necrotizing fasciitis) score: a tool for distinguishing necrotizing fasciitis from other soft tissue infections. Crit Care Med. 2004 Jul;32(7):1535-41. doi: 10.1097/01.ccm.0000129486.35458.7d.
4. Kincius M, Telksnys T, Trumbeckas D, Jievaltas M, Milonas D. Evaluation of LRINEC scale feasibility for predicting outcomes of Fournier gangrene. Surg Infect (Larchmt). 2016 Aug;17(4):448-53. doi: 10.1089/sur.2015.076.
5. Park SJ, Kim DH, Choi CI, Yun SP, Kim JH, Seo HI, et al. Necrotizing soft tissue infection: analysis of the factors related to mortality in 30 cases of a single institution for 5 years. Ann Surg Treat Res. 2016 Jul;91(1):45-50. doi: 10.4174/astr.2016.91.1.45.
6. Doluoğlu ÖG, Karagöz MA, Kılınç MF, Karakan T, Yücetürk CN, Sarıcı H, et al. Overview of different scoring systems in Fournier's gangrene and assessment of prognostic factors. Turk J Urol. 2016 Sep;42(3):190-6. doi: 10.5152/tud.2016.14194.
7. Tang LM, Su YJ, Lai YC. The evaluation of microbiology and prognosis of fournier's gangrene in past five years. Springerplus. 2015 Jan 13;4(1):14. doi: 10.1186/s40064-014-0783-8. eCollection 2015.
8. Czymek R, Hildebrand P, Kleemann M, Roblick U, Hoffmann M, Jungbluth T, et al. New Insights into the Epidemiology and Etiology of Fournier's Gangrene: A Review of 33 Patients. Infection. 2009 Aug;37(4):306-12. doi: 10.1007/s15010-008-8169-x.
9. Uluğ M, Gedik E, Girgin S, Celen MK, Ayaz C. The evaluation of microbiology and Fournier's gangrene severity index in 27 patients. Int J Infect Dis. 2009 Nov;13(6):e424-30. doi: 10.1016/j.ijid.2009.01.021.