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Original Research Article

COMPARATIVE STUDY OF PROPHYLACTIC RETENTION SUTURING VERSUS PRIMARY CLOSURE IN LAPAROTOMIES FOR PERFORATION PERITONITIS AT A TERTIARY CARE CENTRE

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ABSTRACT

Background: Burst abdomen is a significant post-operative complication after laparotomy, particularly in emergencies such as perforation peritonitis. Its occurrence increases the morbidity burden, length of hospital stay, and rate of re-operations. Standard layered closure might fail in these high-risk cases and perhaps warrant the use of alternative techniques like retention prophylaxis suturing. This study seeks to assess the comparative effectiveness of retention suturing and primary layered closure on the burst abdomen prevalence as well as secondary complications. **Materials and Methods:** This clinical study analyzed 60 patients who underwent emergency laparotomy for hollow viscus perforation at Stanley Medical College, Chennai between December 2023 and October 2024. Patients were randomized into two groups: Group A (Primary Closure, n=30) and Group B (Retention Suturing, n=30). Relevant clinical variables, as well as postoperative complications and outcomes gave data which were analyzed using SPSS 21.0 with t-tests and chi-square tests where applicable. **Result:** The retention group had a significantly higher mean age (54.4±12.47 vs. 38.53±13.65 years, p=0.001). Duodenal perforation was the most common diagnosis. Pain scores were significantly lower in Group RA (4.53 vs. 7.23, p=0.001), as were rates of wound dehiscence (2.9% vs. 46.7%, p=0.002), evisceration (1.1% vs. 23.3%, p=0.023), and re-surgery (2.9% vs. 46.7%, p=0.002). Group RA also experienced shorter hospital stays (14.3 vs. 22.23 days, p=0.001) and lower incidences of organ failure and hypotension. There was no significant difference in wound infection rates. **Conclusion:** Retention suturing significantly outperformed primary layered closure in high-risk midline laparotomy cases for perforation peritonitis. It reduced wound dehiscence, postoperative pain, hospital stay, and the need for re-surgery. This technique proves clinically advantageous for selected patients, offering better outcomes and faster recovery, but should be applied based on specific indications rather than as a routine policy.

INTRODUCTION

Peritonitis due to hollow viscus perforation is a surgical emergency with severe morbidity and mortality. Although imaging technology, critical care, and antimicrobial therapy have made significant advances, primary management still remains timely exploratory laparotomy to control damage, which permits prompt action before systemic deterioration occurs.[1] Of great concern in these cases is effective closure of the wound is equally important since there can be features like sepsis, anemia, hypoalbuminemia, and immunosuppression. These factors place a patient at risk for dehiscence and ultimately result in severe case termed burst abdomen.

Burst abdomen or post-op dehiscence refers to separation of fused layers of abdominal wall that occur within the first week after surgery. Emergency procedures done into laparotomy for peritonitis are known to accelerate the phenomenon by even doubling its rate from 0.4% to 3.5%.[2] The

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consequences resulting are evisceration combined with increase recovery date post operation along with additional operative procedures needed leading to increased mortality risk.

The local and systemic factors contributing to burst abdomen are multifaceted. Locally, the inflammatory environment in the peritoneal cavity causes swelling of tissues, infection, and inadequate collagen formation owing to external factors such as diabetes or malnutrition that hinder tissue repair.[3] Healing of contaminated wounds occurs via distinct sequential phases: hemostasis, inflammation, proliferation, and remodeling. Each phase can be altered in high-risk surgical patients which promotes dehiscence of the wound.[4]

Retention suturing is one of several methods devised for this purpose. It has demonstrated effectiveness in alleviating tension on the primary suture line due to full-thickness sutures placed through the skin and abdominal wall with bolster dressings added to protect the sutures. It is beneficial in patients who tend to have their wounds fail owing to sepsis and obesity as well as those with weakened immune systems.[5]

Retention sutures, specifically in the context of comparative studies, have been noted to lower the rates of burst abdomen and reoperation considerably when opposed to primary layered closure, especially during peritonitis cases.[6] The role of these sutures is to support fascial closure while offloading tension so that the central sutures can preserve their structural integrity during the critical early postoperative phase. Retention sutures have been documented not to cause additional surgical site infections or hold-up healing pathways despite concerns regarding pain and discomfort.[7]

Factors such as suboptimal closure technique common in perforation peritonitis were found strongly associated with wound dehiscence in one prospective study containing 1,000 laparotomies.[8] Another study postulated that layered closures—while appearing "anatomically" accurate may fall short on actual mechanical strength which is needed during reinforced closures when dealing with hostile environments inside the abdomen.[9]

Systematic evaluations recent advocate tailored risk appraisal for techniques aimed at closing abdominal walls suggesting inclusion of adjunctive retention sutures in some high-risk framed groups. Prophylactic interventions directed toward reducing risks for bursting as identified by Van Ramshorst et al. through clinical models stand to benefit from these proposed strategies.[10]

Here, this study assesses prophylactic retention suturing versus conventional primary closure in emergency laparotomies for perforation peritonitis. The objective is to measure outcomes such as wound dehiscence, pain, evisceration, length of stay in the hospital, and reoperation rates within a multicentric cohort of ailing surgical patients.

MATERIALS AND METHODS

This was a prospective comparative study conducted in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai. The study was carried out over a 12-month period, from February 2024 to January 2025. The study was conducted in the Department Of Surgery of Stanley Medical College. Patients presenting with clinical and radiological evidence suggestive of hollow viscus perforation were evaluated and taken up for emergency laparotomy in the casualty operation theatre.

A total of patients diagnosed with hollow viscus perforation and undergoing emergency midline laparotomy were included in the study. Using simple random sampling, patients were divided into two groups:

- Group GA (n = 30): Primary closure (layered closure)
- Group RA (n = 30): Prophylactic retention suturing

All participants in the study were registered patients of the Emergency Surgical Services and subsequently admitted to Division of Surgery at Stanley Medical College. Upon arrival, each patient was subjected to an extensive pre-operative evaluation that consisted of a thorough clinical history review and a complete physical examination. Documentation of vital signs was done with meticulous precision. Laboratory investigations included a full blood count, serum electrolytes, renal function tests as well as liver function tests. Imaging studies like erect abdominal X-ray and/or abdominal ultrasound were performed to confirm gastrointestinal perforation. ECG along with serology and crossmatch including Rh factor were completed as well for added perioperative safety.

Patients underwent immediate assessment triage and received timely resuscitative interventions which included administration of intravenous crystalloids to rectify fluid deficit, broad spectrum intravenous antimicrobials for persistent peritonitis, analgesics, and antiemetics for symptomatic relief from pain and nausea. Decompression of the gastrointestinal tract was obtained by insertion of Ryle's tube while urinary catheterization was also done simultaneously for tracking fluid output through the bladder as well as monitoring renal blood supply.

Patients who became stable underwent transfer to the operating room receiving midline laparotomy under general anesthesia for emergency surgery procedure. Relevant intraoperative findings were noted and appropriate surgical procedures such as omental patch closure, resection with anastomosis or appendicectomy were performed depending on the location and nature of the perforation.

All patients within a given study group received identical treatment protocols. The two groups were defined using simple random sampling:

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In Group GA participants were subjected to conventional primary layered closure of the abdominal wall.

In Group RA closure was modified by incorporation of full thickness prophylactic retention sutures applied through all layers except the peritoneum which was left untouched.

These sutures were additionally reinforced with soft bolsters to reduce tension on wound edges and suture cut-through. In both groups, postoperative care provided was identical and included sustained intravenous hydration, antibiotics, analgesics, and nutrition, in addition to attentive observation for clinical deterioration or complications. Each patient was seen daily evaluated for numerous defined outcome variables such as SSI, pain score, seroma formation, dehiscence (burst abdomen), evisceration, or revision surgery.

All relevant data was captured using structured case reporting forms for each individual patient. Patients then underwent outpatient department follow-up visits after discharge for assessment of their wounds and surveillance for any late postoperative complications.

The obtained information was recorded in Microsoft Excel and analyzed using IBM SPSS Statistics Version 21.0. Descriptive statistics were applied to summarize the data set. Continuous variables such as age, duration of hospital stay, and post-operative pain scores were calculated as mean ± standard deviation. These metrics were compared across the two study groups using unpaired t-tests. A p-value threshold of less than 0.05 was regarded as statistically significant for all tests conducted in this analysis which were two-tailed.

Inclusion Criteria

1. Patients with hollow viscus perforation undergoing midline laparotomy.
2. Age > 20 years
3. Confirmed perforation peritonitis on imaging and/or intraoperative findings
4. Emergency midline laparotomy performed within 24 hours of symptom onset.

Exclusion Criteria

5. Refusal to give consent.
6. Age < 20 years
7. Immunodeficient patients (HIV positive or on immunosuppressive therapy)
8. Patients with end stage renal disease or hepatic failure.
9. Known cases of malignancies undergoing radiotherapy or chemotherapy.
10. Major psychiatric illness.

RESULTS

This prospective observational study included 60 patients with perforation peritonitis who were treated with midline laparotomy, classifying the patients into two groups based on surgical technique. In one group layered closure was done while in other group retention suturing was done. Systematic collection of demographics, clinical, and intraoperative variables was performed. The postoperative outcomes were evaluated for both groups to determine how the method of closure affected overall recovery as well as complication rates.

The mean age of patients in the layered closure group was 38.53 ± 13.65 years, whereas in the retention suturing group, it was higher at 54.4 ± 12.47 years. This age difference was statistically significant, with a p-value of 0.001 (unpaired t-test). The most common age group was 51–60 years with 15 cases (24.9%), followed by 12 cases (19.9%) each in the <30 and 41–50 age groups, and 10 cases (16.9%) in the 31–40 and >60 age groups. In terms of sex distribution, males predominated with 46 cases (76.9%) compared to 14 females (22.9%). However, this gender difference between the two closure methods was not statistically significant (Table 1)

Table 1: Baseline Demographic Profile of Study Participants by Closure Method

Parameter	Layered Closure (n = 30)	Retention Suturing (n = 30)	Total (n = 60)	p-value
Closure Method (%)	49.9%	49.9%	100%	–
Mean Age (years)	38.53 ± 13.65	54.4 ± 12.47	–	0.001 Unpaired t-test
Age Distribution (%)				
< 30	–	–	12 (19.9%)	–
31–40	–	–	10 (16.9%)	–
41–50	–	–	12 (19.9%)	–
51–60	–	–	15 (24.9%)	–
> 60	–	–	11 (16.9%)	–
Sex Distribution				
Male	24	22	46 (76.9%)	0.542 Chi-square test
Female	6	8	14 (22.9%)	

The analysis of the diagnosis distribution among the studied cases showed that duodenal perforation was the most frequent condition (84.9%), with 23 cases managed by primary closure and 27 by retention closure. Appendicular perforation and ileal perforation were each noted in 3 patients (4.9%), with appendicular cases slightly more in the primary closure group (2 vs. 1) and ileal perforations only in the primary closure group (3 cases). Gastric perforation was seen in 2 patients (2.4%), evenly distributed between both closure methods. One case (1.9%) of gastric perforation with associated growth

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was managed by retention closure, while one case (1.8%) of colonic perforation was handled by primary closure. The statistical analysis using the Kruskal-Wallis test yielded a p-value of 0.341 (Not Significant) (Table 2).

Table 2: Distribution of Diagnoses and Surgical Procedures by Closure Method

Diagnosis	Total (n = 60)	Primary Closure (n = 30)	Retention Closure (n = 30)	Statistical Summary
Duodenal Perforation	50 (84.9%)	23	27	p = 0.341; Kruskal-Wallis
Appendicular Perforation	3 (4.9%)	2	1	
Ileal Perforation	3 (4.9%)	3	0	
Gastric Perforation	2 (2.4%)	1	1	
Gastric Perforation with Growth	1 (1.9%)	0	1	
Colonic Perforation	1 (1.8%)	1	0	
Overall	–	–	–	

The analysis of the surgical procedures performed showed that omental patch closure was the most commonly employed technique which was used in 50 cases (82.9%), with 23 procedures conducted in the primary closure group and 27 in the retention closure group. Appendicectomy was performed in 3 cases (4.9%), slightly more in the primary closure group (2 cases) than in the retention group (1 case). Layered closure was used in 3 cases (4.9%), all of which were managed with primary closure. Resection with anastomosis was done in 2 cases (2.9%), both under the primary closure category. Less common procedures included ileostomy and layered closure with feeding jejunostomy, each accounting for 1 case (1.9%), with the former in the primary group and the latter in the retention group. The Kruskal-Wallis test yielded a p-value of 0.234, indicating that the difference in distribution of surgical procedures between the two groups was not statistically significant (Table 3).

Table 3:- Distribution of surgical procedures between the two groups

Surgical Procedure	Total (n = 60)	Primary Closure (n = 30)	Retention Closure (n = 30)	Statistical Summary
Omental Patch Closure	50 (82.9%)	23	27	p = 0.234 Kruskal-Wallis Test;
Appendicectomy	3 (4.9%)	2	1	
Ileostomy	1 (1.9%)	1	0	
Layered Closure	3 (4.9%)	3	0	
Layered Closure with Feeding Jejunostomy (FJ)	1 (1.9%)	0	1	
Resection with Anastomosis	2 (2.9%)	2	0	
Overall	–	–	–	

Clear exudate was predominantly found in the retention closure group, whereas purulent and feculent exudates were more associated with the layered closure group. The difference was statistically significant, suggesting less severe contamination in the retention group (Table 4).

Table 4: Type of Peritoneal Exudate and Closure Method

Exudate Type	Layered Closure (n = 30)	Retention Closure (n = 30)	p-value
Clear	19	25	0.001 Kruskal-Wallis Test
Purulent	9	2	
Feculent	2	1	

Hemoglobin levels were significantly lower and total bilirubin levels were significantly higher in the retention group, possibly reflecting more extensive pre-operative inflammation or hepatic involvement. Other biochemical markers showed no significant difference (Table 5)

Table 5: Biochemical Parameters According to Closure Method

Parameter	Layered Closure (Mean ± SD)	Retention Closure (Mean ± SD)	p-value Unpaired t-test
Blood Urea (mg/dL)	47.1 ± 14.44	39.96 ± 33.38	0.329
Serum Creatinine (mg/dL)	1.59 ± 0.35	1.47 ± 1.22	0.679
Hemoglobin (g/dL)	10.68 ± 2.22	9.66 ± 1.63	0.047
Total Bilirubin (mg/dL)	1.89 ± 1.04	2.61 ± 1.39	0.027
Serum Albumin (g/dL)	3.89 ± 1.02	4.08 ± 1.35	0.536

Patients who had undergone retention suturing, postoperative outcomes compared to those who received layered closure. The pain scores reported were significantly lower in the retention group (4.53) when compared to layered closure participants (7.23), alongside reduced duration of hospital stays (14.3 days versus 22.23 days), highlighting improved recovery and comfort. Retention participants showed

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significantly lower rates of severe complications such as organ failure (23.3% retention vs 50% layered) and hypotension (20% vs 50%). Though the layered group exhibited higher rates of wound infection and seroma, these differences were not significant.

The Manheim Peritonitis Index indicated both groups had comparable scores suggesting comparability in severity at baseline, thus reinforcing retention suturing as a safe and effective strategy for emergency laparotomies on patients with perforation peritonitis (Table 6).

Table 6: Postoperative Clinical and Biochemical Outcomes by Closure Method

Parameter	Layered Closure	Delayed Closure	p-Value Unpaired t-test
Manheim Index (mean ± SD)	11.66 ± 8.21	9.76 ± 5.46	0.296
Pain Score (mean ± SD)	7.23 ± 0.84	4.53 ± 1.06	0.001
Seroma Formation (Present)	18 (60%)	9 (30%)	0.020
Organ Failure (Present)	15 (50%)	7 (23.3%)	0.032
Hypotension (Present)	15 (50%)	6 (20%)	0.014
Hospital Stay (mean ± SD)	22.23 ± 2.5 days	14.3 ± 2.43 days	0.001
Wound Infection (Present)	18 (60%)	11 (36.7%)	0.301

The frequency of wound-related complications was far greater in the Layered Closure group as opposed to the Delayed (Retention) Closure group. In the Layered Closure group, wound dehiscence affected 46.7%, whereas only 2.9% of patients in the Delayed group experienced it, which is a significant difference ($p = 0.002$). Evisceration also had higher rates in layered closure cases; 23.3% of eviscerated patients compared to only 1.1% in the delayed group ($p = 0.023$). There were also higher rates of re-surgery needed in the layered group (46.7%) compared with 2.9% in the delayed group ($p = 0.002$). The two groups did not differ significantly concerning the rate of postoperative infection ($p = 0.301$). These results indicate that better outcomes are achieved using delayed closure due to less severe postoperative wound complications occurring when compared to other methods (Figure 1).

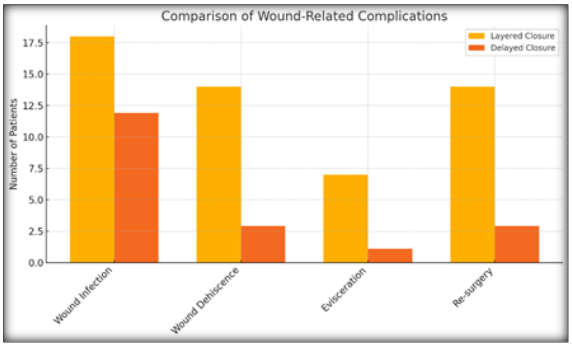

Figure 1: Comparison of wound related complications in studied groups

DISCUSSION

In the current study, it was demonstrated that wound dehiscence was significantly lower in the retention suture group (2.9%) compared with the layered closure group (46.7%). This finding corroborates Wissing et al's work where they noted a substantial reduction in the risk of fascial separation when retention sutures were employed for midline laparotomy patients.[11]

As noted earlier, pain scores were significantly lower in the retention suture group. This is contrary to older notions which assumed that retention sutures would increase postoperative discomfort. More recent explanations could involve techniques like the "chopstick" method described by Matsuoka et al, which applies pressure over a wider area and reduces tissue irritation while warm, thereby increasing comfort measures post intervention.[12]

Our results also noted fewer instances of organ failure and hypotension in the retention suture group. This relates to less severe contamination as indicated by the predominance of clear exudate in that group. This supports Stephen and Loewenthal's work which demonstrated that reducing peritoneal contamination improves some systemic outcomes.[13]

Seroma formation was observed more frequently within our layered group, although this difference was not statistically significant. It is consistent with Bucknall et al who associated higher seroma incidence with poor approximation of tissue closure due to conventional techniques performed on slowly draining tissues during surgery.[14]

We also discovered that retention suturing alleviated mean hospital stay compared with layered closure suturing (14.3 days vs. 22.23 days). This supports Carlson's analysis where he states early mobilization and reduced complication rates translate to lower hospitalization durations.[15]

Evisceration, a severe postoperative complication, was significantly higher in the layered group compared to the retention group (23.3% vs. 1.1%). These results support Poole's arguments in favor of mechanical reinforcements during early postoperative periods to avoid fascial rupture as well as evisceration.[16]

Patients with retention closures required re-surgery less often than those with layered closure (2.9% vs. 46.7%). This supports the proposition by Saik that retention suturing is a safety net method, thereby minimizing chances of intervention thereafter.[17]

Despite having lower hemoglobin and higher bilirubin levels preoperatively, the retention group still favorable post-operative outcomes which defies expectation given risk posed by biochemical severity

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surgical technique seems to outweigh risk factors – a comparable conclusion outlined by Sørensen et al in gastrointestinal surgery analysis.[18]

The Manheim Peritonitis Index indicated no clinically meaningful difference between groups reinforcing comparability of two study arms while supporting internal validity. According to Taylor differing methods of performing surgery have a marked impact on results, even when baseline scores are the same, as is the case in peritonitis.[19]

Lastly, while layered closure exhibited higher wound infection rates (60%) compared to retention (36.7%), these differences were not statistically meaningful. This aligns with Chin et al.'s conclusions which suggested that the immune response and local contamination levels dominate over suture techniques in determining infection rates.[20]

The limitation of this study was its single-centre design as well as the relatively small sample size of 60 patients, which may restrict the generalizability of the findings. The short postoperative follow-up period precluded evaluation of long-term complications such as incisional hernia.

CONCLUSION

This study provides evidence that retention suturing is a far more effective method than conventional layered closure for emergency laparotomies performed due to perforation peritonitis. Patients in the retention group had considerably lower rates of post-operative dehiscence, seroma, evisceration and re-surgery alongside a reduction in length of hospital stay and post-operative discomfort.

The technique does increase operative time but for high-risk patients such as those who are anemic or having hypoalbuminemia among other systemic frailties these risks are overshadowed by the advantages gained. It preserves abdominal wall strength more effectively than traditional techniques while reducing morbidity and improving recovery. Thus, retention sutures should be advocated as protective adjuncts to abdominal surgery especially for critically ill patients that require laparotomy due to gastrointestinal perforations.

REFERENCES

1. Rai A, Huda F, Kumar P, David LE, S C, Basu S, Singh S. Predictors of Postoperative Outcome in Emergency Laparotomy for Perforation Peritonitis; a Retrospective Cross-sectional Study. Arch Acad Emerg Med. 2022 Oct 31;10(1):e86. doi: 10.22037/aaem.v10i1.1827. PMID: 36426170; PMCID: PMC9676704.
2. Gislason H, Gronbech JE, Soreide O. Burst abdomen and incisional hernia after major gastrointestinal operations: comparison of three closure techniques. Eur J Surg. 1995;161:349–54.
3. Jenkins TP. The burst abdominal wound: a mechanical approach. Br J Surg. 1976 Nov;63(11):873-6. doi: 10.1002/bjs.1800631110. PMID: 137024.
4. Irvin TT, Stoddard CJ, Greaney MG, Duthie HL. Abdominal wound healing: a prospective clinical study. Br Med J. 1977 Aug 6;2(6083):351-2. doi: 10.1136/bmj.2.6083.351. PMID: 329940; PMCID: PMC1631112.
5. Shoar S, Khorgami Z. Prophylactic retention sutures in midline laparotomy in high-risk cases to prevent wound dehiscence. J Surg Res. 2012;E1–6.
6. Retha MA. Management of retention sutures as a measure in prevention of abdominal wound burst in patients at high risk post laparotomy. IOSR J Pharm. 2012;2(6):23–8.
7. Edwards M, Graziadio S, Shore J, Schmitz ND, Galvain T, Danker WA, Kocaman M, Pournaras DJ, Bowley DM, Hardy KJ. Plus Sutures for preventing surgical site infection: a systematic review of clinical outcomes with economic and environmental models. BMC Surg. 2023 Oct 3;23(1):300. doi: 10.1186/s12893-023-02187-0. PMID: 37789307; PMCID: PMC10548560.
8. Jensen TK, Gögenur I, Tolstrup MB. High rate of incisional hernia observed after mass closure of burst abdomen. Hernia. 2022 Oct;26(5):1267-1274. doi: 10.1007/s10029-021-02523-4. Epub 2021 Oct 21. PMID: 34674087.
9. Goligher JC, Irvin TT, Johnston D, Macdonald AD. A clinical trial of three methods of closure of laparotomy wounds. Br J Surg. 1975;62:823–9.
10. Van Ramshorst GH, Nieuwenhuizen J, Hop WCJ, Arends P, Boom J, Jeekel J, et al. Abdominal wound dehiscence in adults: construction and validation of a risk model. World J Surg. 2010;34(1):20–7.
11. Wissing J, van Vroonhoven TJ, Schattenkerk ME, et al. Fascia closure after midline laparotomy: Outcome of a randomized trial. Br J Surg. 1987;74:738.
12. Matsuoka J, Gohchi A, Kamikawa Y, et al. Chopstick retention suture for abdominal wounds. J Am Coll Surg. 1995;181:471.
13. Stephen M, Loewenthal J. Persisting with peritoneal lavage in high risk peritonitis. Surgery. 1999;85:6036.
14. Bucknall TE, Cox PJ, Ellis H. Burst abdomen and incisional hernia: Patterns of infection. A prospective analysis of 1129 major laparotomies. Br Med J (Clin Res Ed). 1982;284:931.
15. Carlson MA. Acute wound failure: Severity and predictor variable association. Surg Clin North Am. 1997;77:607.
16. Poole GV Jr. Mechanical factors in abdominal wound closure: Measures to avoid fascial dehiscence. Surgery. 1985;97:631.
17. K.P. Saik. Wound dehiscence—Pathophysiology and prevention. Arch Surg. 1979;10(2):143–146.
18. Sørensen LT, Hemmingsen U, Kallehave F, et al. Risk factors for tissue and wound complications in gastrointestinal surgery. Ann Surg. 2005;241:654.
19. Taylor H. Systematic review: Nonoperative management of perforated peptic ulcer. Gastroenterology. 2007; 133:1059–1066.
20. Chin G, Diegelman R, Schultz G. Basic aspects of cellular and molecular control of wound healing. In: Falabella A, Kirschner R, editors. Wound Healing. Boca Raton FL: Taylor & Francis Group; 2005. p. 17–37.

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