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Research Paper

# A Comparative Study of the Complications Following Laparotomy Wounds Closure With and Without Prophylactic Retention Sutures

MEDICAL SCIENCE

**KEYWORDS :** Zooplankton, Estuary, Acetes, Lucifer, Zoea, Nauplius.

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## ABSTRACT

*BACKGROUND: Wounds and their management are fundamental to the practice of surgery. Surgical wound dehiscence after laparotomy remains a serious complication. To evaluate the effect of prophylactic retention sutures in patients with a high risk for wound dehiscence who underwent midline laparotomy.*

**Patients and methods:**

The comparative study was carried out over 115 patients who underwent either emergency or elective laparotomies in our institute in the 2 year duration spanning from September 2012 to September 2014. Out of these 115 patients, 58 patients had their laparotomy wounds closed with prophylactic retention sutures and they were considered as cases. While the other 57 patients had their laparotomy wounds closed without retention sutures, and they were considered as control group. Out of which 100 patients were came for regular follow up while rest 15 lost their follow up or died. The patients were chosen based on the inclusion and exclusion criteria mentioned below. The study was approved by ethics committee. Informed consent was taken from all the patients.

**Inclusion criteria:**

1) Midline laparotomies with minimum 10 cm wound length closed with primary intention.
2) Cases where retention sutures were taken as a prophylactic measure to prevent wound dehiscence were considered in this study, and not those where retention sutures were used as treatment of burst abdomen.
3) All kind of laparotomies were included, like blunt abdominal trauma, GI obstructions, peritonitis due to viscus perforation, abdominal mass, Koch's abdomen etc.

**Exclusion criteria:**

1) Those in paediatric age group i.e. below 12 years of age were excluded from the study.
2) Cases with stoma exteriorized from the midline main wound were not considered in this study
3) All kind of laparotomies with recent or past history of midline laparotomies were excluded because of the altered structural anatomy of the anterior abdominal wall around the previous wound which may confound the findings.
4) Midline wound closed with retention sutures in cases of relaparotomies for burst abdomen were not included.

Those laparotomies with anterior abdominal wall injured due to blunt or sharp trauma in the form of muscle hematoma, muscle disruption, abdominal wall laceration were excluded from the studies.

The patients with just gaping of the sheath were considered partial WD while those with significant WD leading to exposure of bowel loops and evisceration were considered complete WD.All patients were assessed and categorized pre-operatively by using ASA score.The wound contamination was decided and categorized based on standard criteria. High risk model includes group of those patients who have 2 or more than 2 risk factors for wound dehiscence present.

1. Poor nutritional status (clinical cachexia or S.Albumin< 3.5gm %)
2. Emergent surgery;
3. Intra-abdominal infection (peritonitis);
4. Uraemia (S.urea > 60 mg% and S. Creat >2mg %)
5. Hemodynamic instability (BP<100/70mmhg);
6. Haemoglobin (<10 gm %) (perioperative blood loss or anaemia on presentation)
7. Chronic pulmonary diseases;
8. Clinical jaundice (total bilirubin >1 mg/dl);
9. Diabetes mellitus; FBS > 127mg% or RBS > 140mg%
10. Age >60 y.

**AIM OF THE STUDY:**

To study the rate and extent of post-operative complications in patients whose midline laparotomy wounds are closed with retention sutures and compare with those not closed with retention sutures.

**DISCUSSION: -**

Our study was done over 100 patients. 50 cases had their laparotomy wound closed with Prophylactic retention sutures while the other 50 patients had not.

In this study proportion of total WD was observed less in prophylactic group (12%) than in control group (26%) And even the number of complete WD (evisceration) was observed less in prophylactic group (2%) as compared to control group (6%). However this difference was not found to be statistically significant with P value 0.074.

Then as the rate of WD also depends upon many pre-operative, per-operative and post-operative risk factors, the rate of WD was compared between prophylactic group and control group against each such risk factor. As WD being multifactorial and while comparing the rate of WD against a risk factor, other confounding risk factor cannot be removed and also because the sample size for each variable being small, statistical tests were not applied for such comparison.

In each comparison the outcome showed that prophylactic group showed lesser rate of WD than in control group.

| Risk factor present | WD in Proph gr. | WD in Con. gr. | Total WD rate n=100 | WD rate in Ramneesh et al study (n=50) |
|---|---|---|---|---|
| DM | 16.6% | 36.4% | 26.1% | 8% |
| Uremia | 14.3% | 66.6% | 38.4% | 38% |
| Jaundice | 20% | 50% | 36.3% | 16% |
| Anemia | 10% | 33.3% | 21.1% | 26% |
| Hypoproteinemia | 14.3% | 25% | 20% | 24% |
| Wound infection | 30% | 66.6% | 47.3% | 90% |
| WCC III * | 15.3% | 33.3% | 25% | 44% |

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| | | | | |
|---|---|---|---|---|
| WCC IV * | 20% | 44.4% | 31.5% | 44% |
| Cough | 25% | 40% | 33.3% | 18% |
| Vomiting | 25% | 33.3% | 30.7% | 20% |
| Abdominal distension | 25% | 75% | 50% | 12% |

* WCC= wound contamination category

In our study 19% rate of WD was observed out of which 4% were evisceration which is similar to studies done by **Shukla** et al (10-30% WD and 0-5% evisceration in Indian population).[72]In our study maximum cases of WD was observed in age group more than 60 years (66.6%). Our study showed positive correlation of the increased incidence with the increasing age as was showed by **Halasz** et al. However the results did not match with **Ramneesh** et al. In our study the male: female preponderance to WD was found to be 1.71:1 while in **Ramneesh** et al it was 2.84:1. Our study showed male predominance which was also noted by **Pennickx** et al and **Keil** et al.

In our study 24.5 % WD was observed in emergency surgeries as compared to 12.7% in elective surgeries. The rate of WD was found more in emergency surgeries than in elective ones. Similar trend was also found in study by **Pennickx** et al with 6.7% WD in emergency group and 1.4% in elective group.

In our study 26.1% patients with DM developed WD which was more than the rate shown in study by **Ramneesh** et al (8%).Bybee and Roger et al., reported diminished activity of granulocytes in diabetic patients. In a series of studies of collagen formation in diabetes, Goodson and Hunt have shown that obesity, insulin resistance, hyperglycaemia and depressed leukocyte function interfere with collagen synthesis and thus impair wound healing.

In our study 38.4% uremic patients suffered WD which was comparable to 38% found in **Ramneesh** et al. Similar result was found in studies by **Ellis** et al. In present study 36.3% patients had serum bilirubin >1.0mg%. As we know that the activity of collagen synthesis parallels with the production of prolyl hydroxylase which is decreased in jaundiced patients there by impairing healing capacity. The study by **Ramneesh** et al showed less rate of WD 16% in jaundiced patients.

In the present study 21.1% anaemic patients developed WD which was comparable with **Ramneesh** et study (26%). It has been depicted by earlier studies by **Keill**et al[93], and **Whipple** et al., that anaemic people have poor wound healing and tend to have wound gaping

In our study 20% patients with hypoproteinemia suffered WD which was comparable with **Ramneesh** et al which showed 24%. Hypoproteinemia contributes to prolonged inflammatory phase and impairs fibroplasia, proliferation, proteoglycan and collagen synthesis, neoangiogenesis and wound remodelling

Pre-existing systemic illness contributes to higher ASA score and higher wound dehiscence rates because of increase wound infection. In our study with maximum patients (53.8%) found in ASA IV group. Group I and II ASA patients did not develop WD. However in **Ramneesh** et al 92% patients were with ASA score I E. ASA IV were refused surgery so did not form part of that study. In same study 2% of ASA III category patients developed WD. Another characteristic feature of our study was 25% patients with contaminated wound and 31.5% patients with dirty wound developed WD. In **Ramneesh** et al study 12% and 44% patients with respective wound contamination status had WD. Similar results were found in a study by **Haley** et al., in which they showed contaminated/ dirty wounds to be an important predictor for wound infection

The increase in intra-abdominal pressure because of nausea, vomiting or cough results in breakage of suture, undoing of knots or pulling through the tissue. In our study 36.6% patients with one or the other cause of raised IAP like cough, vomiting or abdominal distension developed WD. While **Ramneesh** et al study showed 50 % WD in such types of patients. It has been proved by Jenkin et al.,in his study that facial layers tend to lengthen as the wound distends, whereas suture length remains the same leading to breakage of suture, undoing of knot or pulling through tissue

Post-operative wound infection was found to be single most common factor observed in 90% of **Ramneesh** et al patients as a cause of abdominal wound dehiscence. It has been shown by various other studies that tensile strength of staphylococcusaureus contaminated wounds in rat on 6th post-operative day was much decreased. These infected wounds slowly break down and then heal by granulation tissue. Results of our study did not match with previous studies as in our study 47.3% patients of wound infection developed WD. The mean post –op duration of developing WD in our study was 7$^{th}$ POD with range 6$^{th}$ to 10$^{th}$ day which was comparable to **Zhamak Khorgami** et al study. The **Zhamak Khorgami** et al study of high risk patients showed 13.5% patients of WD in control group and 4.1% in Prophylactic group with n=295. Our study also showed significant reduction in rate of WD in prophylactic group (11%) as compared to control group (40%) among high risk patients with n=51. However in non-high risk group no significant difference was noticed between prophylactic (12.5%) and control (12%) group.

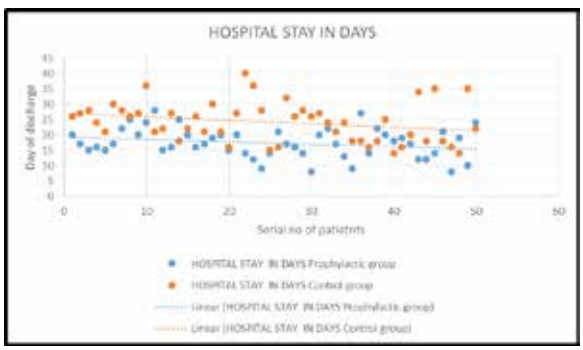
| | **Our study-High risk** gr of | **Zhamak Khorgami** et al study |
|---|---|---|
| WD in Proph gr. | 11.5% | 4.1% |
| WD in Con. gr. | 40% | 13.5% |
| P value | 0.044 | 0.007 |

No consensus for the level of pain experienced after retention sutures is present. **Rink** et al. reported that the pain resulting from retention sutures is much more intense on 9$^{th}$ POD after the surgery, often leading to premature removal of the sutures; this is the period during which most abdominal WDs occur. The results of **Zhamak Khorgami** et al study showed that postoperative pain is not significantly different during the first 3 d after surgery but it is more severe in intervention group in the 4th postoperative day. Thus, retention sutures may cause more severe pain days after surgery when the severe postoperative pain has been relieved. Similar results were found in our study with no difference in pain between two groups up to 4$^{th}$ POD. The patients in prophylactic group felt more pain on 5$^{th}$ and 6$^{th}$ POD as compared to control group. This is one of the major negative side –effect of the retention sutures. However this factor can be easily controlled by adequate analgesia. Even patient controlled analgesia can be tried to reduce post op pain. But the cost of treatment following WD definitely overdrives the cost of extra analgesia required.

In **Zhamak Khorgami** et al study, no significant difference was found in the post-op hospital stay between the prophylactic group and control group which was observed to be average 20.4±5.6 and 21.3±6.9 respectively. While in our study the average hospital stay observed in prophylactic group (17.3±3.8) was significantly low than that in control group (24±5.3). This was because in control group the patients with partial WD, wound infections, cough, vomiting, DM, poor nutritional status, peritonitis and uraemia had to be kept in hospital for observation and regular dressing of the wound to prevent any wound dehiscence. And those patients with evisceration and re-suturing of the wound in control group had to remain in hospital for longer duration for completion of the treatment. Among the prophylactic group even those patients with partial WD were discharged once the granulation tissue layer was observed in the wound. The evisceration and

further gapping of the sheath is prevented by the retention suture.

| Post-op day of discharge | Prophylactic gr. (out of 50 pts) | Control gr. (out of 50 pts) |
|---|---|---|
| | | |
| 0-5 | 0 | 0 |
| 6-10 | 5 (10%) | 0 |
| 11-15 | 13 (26%) | 3 (6%) |
| 16-20 | 21 (42%) | 12 (24%) |
| 21-25 | 9 (18%) | 12 (24%) |
| 26-30 | 2 (4%) | 16 (32%) |
| 31-35 | 0 | 4 (8%) |
| 36-40 | 0 | 3 (6%) |
| Total | 50 | 50 |




Complications like skin necrosis (4%), stich granuloma (2%), stitch site sinus (1%), were observed only in prophylactic group while scar hypertrophy was observed more in prophylactic group (8%) compared to control group (2%). This is the major negative

Incisional hernia was observed more in control group (4%) than in prophylactic group (2%). The incidence of incisional hernia recorded being small, the difference observed between two groups was not found statistically significant. Single post-dehiscence mortality was observed in control group (7.6%), while none in prophylactic group.

**V. CONCLUSION: -**

Wound dehiscence being a multifactorial complication of midline laparotomy wounds, control and correction of the risk factors is important to prevent any incidence of wound dehiscence. Following proper and standard technique of wound closure and proper choice of suture material are the primary measure to control wound dehiscence. Pre-operative antibiotics, pre-operative correction of anaemia and hypo-proteinemia, adequate intra-operative aseptic precautions, proper post-operative antibiotics, regular dressing of wound with proper aseptic precautions etc. are the important measures to prevent wound dehiscence.

**However despite all this control measures, when patient is at high risk for wound dehiscence, retention sutures should be used prophylactically to reduce the rate of WD and evisceration.**

We found in our study that rate of WD are reduced significantly if retention sutures are used prophylactically in high risk patients. However the rate of WD was found similar in the non-high risk patients in both groups. **Hence it can be concluded that, retention sutures does prevent WD in patients with multiple high risk factors.**

Again it was found in our study that **use of retention suture reduces post-op hospital stay**. The patients with partial WD or skin infection or poor nutritional status or uncontrolled cough, in whom prophylactic retention sutures are not taken, are needed to be kept in hospital for continuous medical supervision and daily dressing of the wound. These are the patients who are more prone to evisceration. And any such event far away from hospital will lead to mortality. However the retention sutures prevents evisceration even in patients who have developed gapping of the sheath. Such patients can be discharged when the open wound is clean, free of slough and layer of granulation tissue is formed and fit for discharge from all other perspectives. The abdominal binder is recommended in such patients to prevent pain and sudden evisceration. Reduction in post-op hospital stay greatly reduces the overall cost of treatment and relieves extra financial burden of the patient.

On the other hand, retention sutures have few negative side-effects. **Out of them post-op pain and prominent scar are the two most unpleasant side effects.** The post-op pain can be managed by adequate analgesia and even patient controlled analgesia if at all required. However the scar produced by retention sutures and scar hypertrophy in some cases are unacceptable especially in young females. **Even few incidences of stitch granuloma and stitch site sinus due to retention sutures are also noted**.

Hence it is important to make a proper choice of patient for prophylactic retention suture. The use of retention sutures as prophylactic measure to prevent wound dehiscence can be justified against the negative side-effects of scar and pain only if patient is having multiple risk factors responsible for wound dehiscence.

We need to develop a more dependable Predictive Model for wound dehiscence considering proper weightage of various risk factors. This will help us in proper selection of the patients for the use of prophylactic retention suture as a measure to prevent wound dehiscence.

**A Predictive Validation Risk Model by Van Ramhorst** is an attempt in this direction. Study in this direction using these and such other risk models is required to improve the outcomes in our efforts to prevent wound dehiscence.

**Incisional hernia** again depends upon many factors among which suture technique and suture material are more important. Our study observed very few patients with incisional hernia. This was because many patients failed to make timely follow up visits after discharge. To study the role of retention suture in prevention of incisional hernia further studies are required with larger sample size and longer duration of adequate follow-up.

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