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SICOT AWARD PAPERS

A comparison of the use and non-use of closed suction wound drainage in open reduction and internal fixation of femoral shaft fractures

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Abstract

Purpose

The aim of this study was to determine if the routine use of closed suction wound drainage is justified following open reduction and internal fixation (ORIF) of femoral shaft fractures.

Method

This was a prospective comparative study of two study groups: those with post-operative closed suction drainage (WCSD) and those not with closed suction drainage (NWCSD).

Results

Fifty-six patients, twenty-eight each for the two cohorts, were recruited for this study. Five patients (17.9%) in the WCSD group and only one patient (3.6%) in NWCSD group had surgical site infection ($p = 0.20$). Four patients (14.3%) in the WCSD group and nine (32.1%) in NWCSD group had wound dressing reinforcements ($p = 0.21$).

Conclusion

There was generally no statistically significant difference in the incidence of wound infections, strike through bloodstain with wound dressing reinforcement and duration of hospital stay in patients with and without closed suction wound drainage after ORIF of femoral shaft fractures. The duration of the injury may however influence the decision to use or not use wound drain after surgery.

Keywords Closed suction drainage · Internal fixation · Femoral fractures · Surgical site infection · Dressing reinforcement

Introduction

A surgical drain is a device or an appliance that acts as a deliberate channel or conduit through which established or potential collection of pus, blood or bloody fluid egress from the body. Closed suction drainage (CSD) is a tube drain that is aided by a source of negative pressure connected to it [1–3].

CSD is widely and in many cases routinely being used in orthopaedics, which include fracture and spine surgery, arthroplasties and even arthroscopy [4, 5].

Surgical drains and drainage techniques have evolved over time. Despite studies that challenged the efficacy of prophylactic drainage after clean orthopaedic procedures,

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prophylactic drainage continues to be practised even with a lack of clear evidence that they improve outcomes [5–7]. It is believed that many orthopaedic surgeons have formed 'personal opinions' on why they use drains [6, 7].

Post-operative wound drainage is generally believed to reduce surgical wound haematoma formation which may reduce the risk of surgical site infection. Some previous studies, however, could not establish any benefit of post-operative surgical wound drainage after fracture fixations, with some authors reporting increased incidence of wound infection, transfusion requirements and longer hospital stay with the use of closed suction drains, while a few suggest that post-op wound drainage will reduce the incidence of dressing reinforcement for strike through bloodstain [4–6, 8, 9].

This prospective comparative study sought to determine if the routine use of CSD is justified following open reduction and internal fixation (ORIF) of femoral shaft fractures with plates or intramedullary nails. The specific objectives were to compare (1) the incidence of wound infection between the drained and undrained group, (2) the need for wound dressing changes or reinforcements in the two populations, (3) the duration of hospital stay between the drained and undrained group and (4) to identify other complications associated with the use of closed suction drainage.

Materials and methods

The comparative study was approved by the institutional research ethics board. All patients gave their oral and written informed consent for participation in the study before recruitment.

Adult patients 18 years and above with femoral shaft fractures and scheduled for open reduction and internal fixation (ORIF) were recruited for the study from July 2015 to September 2016. The patients were sequentially assigned to the two study groups A and B. All consecutive odd numbers as they were being recruited for the study were assigned to group A—with **c**losed suction drain group (WCSD)—while consecutive even numbers were assigned to group B—not with closed suction drain group (NWCSD). Exclusion criteria are patients with open fractures; patients with bleeding disorders and/or abnormal clotting profile; patients with systemic and/or immunosuppressive conditions such as chronic renal disease, chronic liver disease, retroviral disease; patients that underwent closed reduction and internal fixation (CRIF); patients with history of previous surgery on the same femur; patients with suspected pathological fractures from bone tumour and patients who did not give their consent.

Intra-operative protocol

A pre-operative intravenous antibiotic (1 g ceftriaxone) was administered to all the patients at the induction of anaesthesia. The surgical site prepared with chlorhexidine and methylated spirit. The procedures were either undertaken by either a consultant or a senior registrar as the lead surgeon.

ORIF of the fractures was done with either a locked intramedullary nail or with broad dynamic compression plate/screws. This was done using a postero-lateral exposure of the femur in all the patients, direct reduction and fixation done.

The WCSD cohort had a unit of a suction drain (Uptimed Vac Set®, India) inserted below the fascia lata, through a different stab incision. The drains were anchored with a non-absorbable suture (ethilon 0) and the surgical wound closed in layers with vicryl 2 and ethilon 2/0 sutures.

The dressing was standardised and consisted of six layers of gauze, two layers of cotton wool and two rolls of 6″ crepe bandage used to hold the dressings. The NWCSD cohort had similar dressing layers but with no suction drain.

Outcome measurements

Patient assessment continued post-operatively for evidence of wound infection, strike through bloodstain on dressing, drain complications and duration of hospital stay before discharge. Patient's clinical status was monitored closely, with emphasis on the temperature, pulse rate, respiratory rate, blood pressure and the state of the wound.

A minimum of full blood count (FBC) was done in all the patients post-operatively; other tests such as blood sugar were done when indicated.

The wound dressing was observed for strike through bloodstain at one hours, six hours and 24 hours post-operatively, and immediate dressing reinforcement was done if any bloodstain was observed.

The wound drains were monitored closely by the author for any complication and were removed 48 hours after surgery.

Presence of wound infection was diagnosed based on Centre for Disease Control (CDC) criteria.

Wound swab was taken for microscopy, culture and sensitivity (m/c/s) test when indicated. The wounds were routinely inspected between fifth to seventh day, 14th day at the removal of stitches, and at follow-up visit at six weeks and 12 weeks, for undue tenderness, discharge, local warmth and dehiscence.

Statistical analysis

This was performed using SPSS version 20 (SPSS 20). Univariate analyses were done, and frequency distribution, mean, and standard deviation of epidemiological data and other variables were displayed on a chart or table. Paired,

normally distributed continuous variables were analysed with Student's t test; the association between the variables were analysed using the Pearson's chi-square or Fisher's exact test. A p value of < 0.05 was set as a threshold for statistical significance.

Results

A total of fifty-six patients were recruited from July 2015 to September 2016. Twenty-eight patients were in group A—(WCSD)—and another twenty-eight in group B—(NWCSD). The two groups were comparable in terms of their baseline characteristics (Table 1). The age range of the patients was 18–68 years, with 26–35 years being the most commonly affected age group in the two study population. The most frequent associated injury was other long bone fractures, which was seen in three patients (10.7%) in the WCSD group, and six patients (21.4%) of the NWCSD group.

The only case of surgical site infection in NWCSD group and four cases with surgical site infections in WCSD group occurred within two weeks, while the remaining one infection case in the WCSD group was seen at six weeks after fracture fixation. Staph aureus was isolated in two cases, coliforms in another two, while in the remaining two no organism was isolated. They were all superficial infections, and all were resolved with serial wound dressings and antibiotics (Table 2).

Most of the patients with wound infection were patients with closed suction drain (WCSD) whose fractures were more than three months old before surgery ($p = 0.018$) (Table 3).

Statistical analysis of the duration of injury before surgery and with dressing reinforcement for strike through bloodstain showed that seven out of the nine patients with dressing reinforcement in NWCSD group (77.78%) had injuries lasting longer than three months (Fig. 1). This was statistically significant ($p = 0.03$) (Table 3).

In the WCSD group, the minimum duration of stay was eight days while the maximum duration was 89 days with a mean of 31.68 ± 20.32 days. In the NWCSD group, the minimum duration of stay was 13 days and the maximum duration of stay was 99 days with a mean of 34.14 ± 24.62 days. The t test for equality of means did not show any statistical difference in the duration of hospital stay between the groups ($p = 0.85$). Majority of the patients (42.9% for WCSD and 50% for NWCSD) were hospitalised between two to four weeks (Fig. 2).

Complications of CSD in WCSD group include vacuum system failure in three (10.7%) and drainage tubing extrusion in one (3.6%).

Discussion

The individual group's infection rate was 17.9% in WCSD cohort and 3.6% in NWCSD cohort similar to another study with a higher incidence of wound infection in the drain group (12.8%) and 3.2% in the undrained group [6], but no statistical difference. Similar studies also concluded that there was no statistical difference in the incidence of wound infection with or without closed suction wound drainage [5, 9–13]. Cobb et al. [14], however, reported a higher incidence of wound complications including infection, partial dehiscence and ecchymosis in the drained patients compared with the undrained patients.

The higher incidence of wound infection in the drained group seen in this work could be related to post-operative drain management which requires the drain to be emptied at intervals. This practice could predispose the affected surgical wound to increased risk of surgical site infection as the drainage tubing could serve as a conduit for infection during drain reservoir emptying [5]. Three out of the five patients (60%) with surgical site infection in WCSD group had injuries lasting at least three months prior to surgery, majority of these patients with older injuries were patients with mal-unions and non-unions whose surgeries relatively lasted longer and with more extensive tissue dissections that could predispose the wounds to infection. Statistical analysis on the duration of

Table 1 Demographic data of the patients in the two study groups

Patients' demographics	WCSD group	NWCSD group	p value
n	28	28	
Age (mean) years	40.32 ± 15.25	39.2 ± 13.18	0.77
Sex (M/F)	17/11	18/10	0.76
Operated femur (right/left)	15/13	17/11	0.78
Patients with associated injuries (other long bone fractures, pelvic injuries, etc.)	6/28	12/28	0.89
Presence of comorbidities (diabetes, obesity, tobacco use, etc.)	9/28	7/28	0.77
Type of implant used (locked IM nail/plate and screws)	23/5	23/5	1.000
Category of lead surgeon (consultant/senior registrar)	17/11	18/10	1.000

Table 2 Occurrence of surgical site infection and strike through bloodstain with wound dressing reinforcement between the two groups

Outcome measured	WCSD group *n* (%)	NWCSD group *n* (%)	*p* value
Occurrence of surgical site infection	5/28 (17.9%)	1/28 (3.6%)	0.20
Occurrence of strike through bloodstain/wound dressing reinforcement	4/28 (14.3%)	9/28 (32.1%)	0.21

injury prior to the surgery and wound infection was significant ($p = 0.018$).

Varley et al. [15] using ASEPSIS wound scoring system demonstrated a significant rate of wound infections in the undrained patients in a comparative study, the conclusion which is at variance to the results of this study.

This study showed that there were thirteen (23.2%) incidences of strike through bloodstain with nine in the NWCSD group. A study reported more need for wound dressing reinforcement for strike through bloodstain among patients without wound drain [7, 16]. Ikpeme et al. [6] noted only one case (3.2%) of dressing reinforcement in the group with drain and none in the no-drain group that was, however, not significant. This finding is in agreement with the conclusion by Akinyoola et al. [10] who reported no significant difference in the rate of wound dressing reinforcement for strike through bloodstain.

This increased need for dressing reinforcement in the absence of drain was documented in arthroplasty studies; analysis of the results demonstrated that significantly more patients who were not managed with a drain needed reinforcement than did those who were managed with a drain [17–20]. Leb et al. [21], however, noted that dressing staining persisted longer in the drained group requiring multiple dressing changes compared with the patients without drainage, though the difference was not significant.

Further statistical analysis between the duration of injury and the rate strike through bloodstain with dressing reinforcement in NWCSD cohorts showed that seven out of nine (77.78%) were patients with injury older than three months ($p = 0.03$). This was statistically significant. The reason for this could be as a result of more extensive dissection needed in some of the cases of femoral shaft mal-union and non-union.

The study did not establish any statistical difference in the length of stay in the hospital between the two groups ($p = 0.85$). The slightly longer duration of stay of the NWCSD could be as a result of higher number of patients with associated injuries which was 46.4% against 21.4% in the WCSD group. The management of these other injuries may have contributed to their slightly longer stay though not statistically significant.

Other studies that compared the duration of hospital stay in patients with suction drain and those without it after clean orthopaedic surgical procedures failed to establish any statistically significant difference in the length of hospital stay in the patients [7, 9, 19, 22–24].

Only very few complications were documented in the patients who had closed suction drain. The commonest complication seen was vacuum system failure which may have been due to possible factory fault or inefficient connection of the drain system. Durai et al. [25] had reported in a review article submitted that vacuum drains become ineffective once the vacuum is lost; this could be responsible for some of the cases of strike through bloodstain seen in the WCSD cohort.

The drain extrusion may have occurred due to the wrong technique in the drain anchorage. Cobb et al. [14] noted three cases of drain complications in their series; In two of which, patients needed additional general anaesthesia for wound exploration and drain removal. Varley [15] also reported that one drain was inadvertently stitched in and required surgery to remove it, with generally increased re-operation rate in the

Table 3 Effect of the duration of injury with the occurrence of surgical site infection and strike through bloodstain with wound dressing reinforcement in the two groups

Duration of injury (age of the fracture)	WCSD group		NWCSD group	
	n (%)		*n* (%)	
	Presence of surgical site infection	Presence of strike through bloodstain	Presence of surgical site infection	Presence of strike through bloodstain
< 3 weeks	0 (0)	1 (3.57)	0 (0)	2 (7.14)
3 weeks–3 months	1 (3.57)	0 (0)	1 (3.57)	0 (0)
> 3 months	4 (14.29)	3 (10.71)	0 (0)	7 (25)
p value	0.018	0.633	0.013	0.032

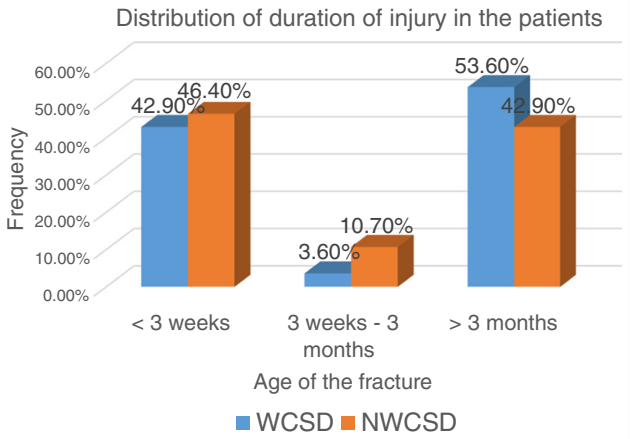

Fig. 1 Distribution of patient's duration of injury

drained group though not statistically significant. In contrast, however, we did not notice such serious complications in our patients who had drain.

Limitations of the study are the short follow-up period and the small size of the study population.

Conclusion

There is generally no statistically significant difference in the incidence of wound infection and strike through bloodstain with wound dressing reinforcement in patients with and those without closed suction drain after ORIF of femoral shaft fractures. However, in fractures more than three months old, non-use of the closed suction drain was associated with a statistically significant incidence of strike through bloodstain with wound dressing reinforcement while the incidence of wound infection was statistically significant in these older fractures with the use of the closed suction drain.

These findings may suggest the relevance of duration of injury with the decision to use or not use a closed suction drain after fracture fixation. We recommend further studies with a larger study population and long-term follow-up on the significance of our findings to allow for a definite conclusion to be made on the merits and/or demerits of post-operative closed suction wound drainage in femoral shaft fracture surgery.

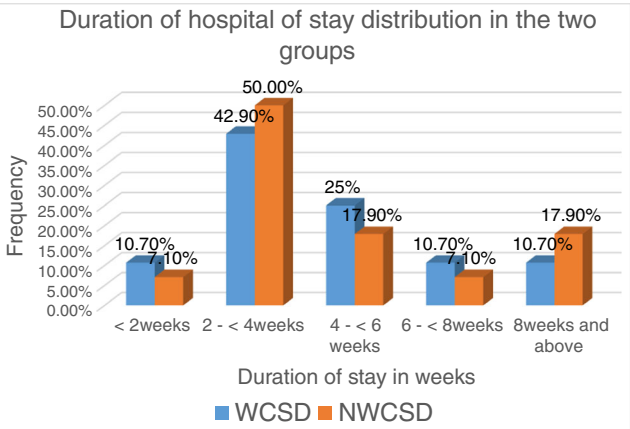

Fig. 2 Duration of hospital stay in the two groups

Compliance with ethical standards

The comparative study was approved by the institutional research ethics board. All patients gave their oral and written informed consent for participation in the study before recruitment

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