

## Original Article

EFFICACY OF CLOSED SUCTION DRAINAGE  
IN ANTERIOR SPINAL FUSION  
FOR LUMBAR SPINAL TUBERCULOSIS

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**Abstract** [Objective] Recently, the effectiveness of closed wound drainage has been evaluated for various types of orthopedic surgery. Some studies showed insufficient evidence to support the routine use of a drain. In the current analysis, the efficacy of closed suction drainage in anterior spinal fusion for lumbar spinal tuberculosis was retrospectively evaluated. [Patients and Methods] Ninety-one consecutive patients treated from January 1997 to January 2016 were included. Before 2006, a closed suction drainage system was placed immediately before wound closure (31 patients). From 2007, no drain was used (60 patients). The two groups of patients were compared regarding postoperative laboratory data (hemoglobin, albumin, and C-reactive protein [CRP]), postoperative complications (deep hematoma, paralysis, wound infection, wound healing, and wound discharge), and healing of the tuberculous lesion. [Results] There were no significant differences in decrease of hemoglobin and albumin between the second and seventh postoperative day. On the other hand, CRP showed a significantly smaller decrease in patients treated with a drain. Deep hematoma and postoperative paralysis were not detected in either group. Surgical site infection was detected in two patients with a drain. Delayed wound healing was noted in three patients with a drain and one patient without a drain. Persistent discharge was noted in nine patients with a drain. All patients showed excellent healing of the tuberculous lesion. [Conclusion] Comparison between patients with and without a suction drain did not show any definite advantage of drainage. Therefore, the routine use of a drain in anterior spinal fusion for lumbar spinal tuberculosis is not recommended.

**Key words** : Spinal tuberculosis, Drainage, Postoperative complication

**Introduction**

Closed wound suction drainage is commonly used in posterior spinal surgery to prevent postoperative hematoma, which can result in paralysis or wound infection. It is also used in anterior spinal fusion for spinal tuberculosis for the same reasons, as well as for the purpose of pus drainage. However, it is questionable whether drainage placement for removing pus from the surgical site is necessary after thorough debridement with anti-tuberculous drug treatment. Recently, the efficacy of closed wound drainage has been evaluated for various types of orthopedic surgery, due to its potential adverse effects, including wound contamination via the drainage tube or excessive bleeding. Some of these studies showed insufficient evidence to support the routine use of postoperative drainage<sup>1)2)</sup>. From 2007, we stopped using closed suction drainage in anterior spinal fusion surgery for lumbar spinal tuberculosis in order to avoid the risk of postoperative infection. In the current study, we retrospectively evaluated the

efficacy of closed suction drainage in anterior spinal fusion for lumbar spinal tuberculosis by comparing patients with versus without drain placement.

**Patients and Methods**

We retrospectively reviewed 91 consecutive patients underwent anterior spinal fusion for lumbar spinal tuberculosis from January 1997 to January 2016. The surgery was performed with the patient under general anesthesia. Debridement and tricortical iliac bone grafting were performed using the standard retroperitoneal approach. Before 2006, closed suction drainage systems (a 28FG catheter connected with an under water sealed drain system) were placed immediately before wound closure. Postoperatively, the drains were removed when the daily amount of drainage decreased to little or none. The drain insertion site was sutured after the removal. After 2007, no drain was used. Patients who underwent anterior and posterior fusion were excluded from the analysis. All patients received antibiotics using a standard anti-tuberculous drug

regimen or modified regimens according to drug sensitivity and tolerability. All patients were alive when the regimen was completed. There were no patients with multi-drug resistant tuberculosis.

Overall, 31 patients were treated with a drain and 60 patients were treated without a drain (Table 1). The two patient groups were compared regarding postoperative serum data (hemoglobin, albumin, and C-reactive protein [CRP]), postoperative complications (deep hematoma, paralysis, wound infection, delayed wound healing and persistent wound discharge), and healing of the tuberculous lesion. Serum values of hemoglobin, albumin, and CRP were measured at the second and seventh postoperative days. Differences between the values at the seventh day and those at the second day were compared. Data on postoperative complications were obtained up to one month after surgery. Cure of the tuberculous lesion was assessed at the time of completion of the anti-tuberculous drug regimen. The Mann-Whitney U test was used to analyze postoperative laboratory data. Fisher's exact test was used to assess differences in the incidence of complication. Values are reported as means with 95% confidence intervals.

### Results

There were no significant differences between groups in the degree of hemoglobin and albumin decrease from the second to the seventh postoperative day. The difference in CRP between the second and seventh day showed a smaller decrease in patients treated with a drain, which was statistically significant. Deep hematoma and postoperative paralysis were not detected in either group. Moderate dressing discharge was noted in one patient in each group. Surgical site infection which required intravenous antibiotics treatment occurred in two patients treated with a drain. Both of these

patients showed persistent discharge of the drain insertion site after its removal, where methicillin sensitive *Staphylococcus aureus* was detected by bacterial culture. Delayed wound healing was noted in three patients with a drain and one without a drain. Persistent discharge was noted in nine patients with a drain and no patients without a drain; this difference was statistically significant. All patients showed excellent healing of the tuberculous lesion and no patient showed a prolonged course of healing (Table 2).

### Discussion

The use of closed suction drainage in orthopedic surgery is a common practice for the reduction of hematoma, which might have provided significant benefit in the era when techniques for controlling intraoperative bleeding or postoperative surgical site infection were not as effective as present day practices<sup>3</sup>. On the other hand, a considerable number of studies could not show clear evidence of an advantage in the use of a drain or a disadvantage in the absence of a drain in the last two decades, leading to a recommendation not to routinely use suction drainage<sup>1</sup>. In studies on single-level lumbar laminectomy, Payne et al. and Kanayama et al. concluded that the use of a drain did not influence the incidence of complications such as hematoma or wound infection<sup>4,5</sup>. Brown et al. reported similar findings in a study on multiple-level lumbar laminectomy<sup>6</sup>. Diab et al. evaluated outcomes of closed suction drainage after posterior spinal fusion with instrumentation for adolescent idiopathic scoliosis, and showed that more patients treated with a drain received postoperative transfusions<sup>7</sup>. Walid et al. retrospectively reviewed patients who underwent posterolateral fusion and posterior interbody fusion, and found no significant differences in wound infection rates but significant differences in postoperative fever and posthemorrhagic anemia in patients with drains<sup>8</sup>. In a study

**Table 1** Patients' characteristics

Characteristics	1997–2006 Drain (n=31)	2007–2016 No drain (n=60)	P value
Age, years (mean ± S.D.)	55.8 ± 17.0	67.7 ± 15.4	< 0.01
Male/Female	19/12	31/29	
Pulmonary tuberculosis	14	31	
Cavitary lesion	2	3	
Non-cavity lesion	11	19	
Miliary	1	7	
Pleural	0	2	
Immunocompromised	5	8	
Diabetes mellitus	2	6	
Receiving systemic steroids	2	1	
Liver cirrhosis	1	1	
Fusion type			
Single-level fusion	18	49	
Two-level fusion	13	11	
Operating room time (min)	210.5 ± 87.4	280.1 ± 86.4	< 0.01
Estimated blood loss (ml)	797.5 ± 469.1	484.6 ± 310.4	< 0.01
Duration of drainage placement (days)	7.2 ± 5.5	—	
Total amount of drainage (ml)	581.9 ± 402.5	—	

**Table 2** Comparison of variables in patients with and without postoperative drain placement

Characteristics	Drain (n=31)	No drain (n=60)	P value
Hemoglobin (g/dl)			
Day 2 post-operation	10.05 ± 1.47	9.58 ± 1.43	0.17
Day 7 post-operation	9.79 ± 1.29	9.76 ± 1.32	0.86
Difference between Day 7 and 2	-0.26 ± 1.36	0.18 ± 0.59	0.21
Albumin (g/dl)			
Day 2 post-operation	2.85 ± 0.38	2.50 ± 0.45	<0.01
Day 7 post-operation	2.89 ± 0.41	2.66 ± 0.41	<0.01
Difference between Day 7 and 2	0.04 ± 0.39	0.15 ± 0.32	0.16
CRP (mg/dl)			
Day 2 post-operation	6.35 ± 5.08	10.68 ± 5.49	<0.01
Day 7 post-operation	4.43 ± 3.06	3.19 ± 1.96	0.09
Difference between Day 7 and 2	-1.92 ± 4.87	-7.49 ± 5.42	<0.01
Moderate dressing discharge	1	1	0.50
Wound infection	2	0	0.21
Delayed wound healing	3	1	0.09
Persistent discharge	9	0	<0.01
Prolonged course of healing of TB	0	0	-

on risk factors for surgical site infections following posterior spinal fusion, Rao et al. concluded that prolonged duration of closed suction drainage was a strong independent risk factor for infection<sup>9</sup>). Within our knowledge, there is no study evaluating the efficacy of closed suction drainage after anterior spinal fusion; therefore it is impossible to compare our results directly with any previous investigation. In addition, it is also impossible to simply adopt the results of the studies regarding posterior spine surgery to anterior spinal fusion, since the significance of drainage placement is quite different between these two procedures. For example, postoperative paralysis due to hematoma in anterior spinal fusion is very rare because retroperitoneal space surrounding anterior part of the spine is flexible and spacious compared with the posterior part that is covered by rather rigid erector muscle of the spine, which makes the significance of drainage placement less important in anterior spinal fusion.

On the other hand, abscess drainage is a basic practice in the treatment of infectious disease, including spinal infection, going back to the report by Pott concerning abscess drainage for spinal tuberculosis<sup>10</sup>). However, with the advent of antibiotics, chemotherapy now plays a major role in the treatment of infection including tuberculosis. Spinal tuberculosis is different from other spinal infection in some aspects, for example it does not require abscess drainage as long as anti-tuberculous therapy is effective and the abscess is asymptomatic, even if the abscess is moderate or large in size. Anterior spinal fusion is indicated when abscess formation or severe destruction of the spine induces paralysis, intractable pain, or severe deformity. Diseased tissue and pus are radically debrided before bone grafting; therefore, the use of closed suction drainage in this procedure has little significance in terms of infection treatment. Anterior spinal fusion for spinal tuberculosis in combination with anti-tuberculous drug therapy has been a standard treatment since Hodgson's

report in the 1950's. At that time, he already stated that placement of a drain is not necessary for this procedure<sup>11</sup>).

The major limitation of this study is its retrospective design. In view of recent criteria of infection prophylaxis, the duration of drainage placement might be too long. Additionally, due to the rarity of the disease and the surgical procedure, the number of the patients is relatively small.

At the author's institute, we have not used suction drainage for anterior spinal fusion from 2007; there have been no cases of deep hematoma requiring drainage or postoperative paralysis. On the contrary, although the author was unable to show a significant difference, the incidences of infection and persistent discharge in patients treated with a drain were greater than those among patients with no drain. Furthermore, postoperative CRP showed smaller decreases by the seventh postoperative day in patients with a drain, which was statistically significant. Since this study did not demonstrate a definite advantage of the use of a drain, the author believes that a routine use of a drain in anterior spinal fusion for lumbar spinal tuberculosis is not necessary. However, if hemostasis is not definitively achieved intraoperatively, such as in patients with bleeding disorders, placement of a drain should be considered. In such cases, the drain should be removed as soon as possible in order to prevent infection.

### Conclusion

The efficacy of closed suction drainage in anterior spinal fusion for lumbar spinal tuberculosis was retrospectively evaluated. Comparison between patients treated with a drain and without a drain did not show any definite advantage of drain placement. The routine use of a drain in anterior spinal fusion for lumbar spinal tuberculosis is not recommended.

### Acknowledgement

The author express cordial gratitude to Dr. Kazuhiko Imoto,

Director of Orthopedic Surgery in our hospital, for giving me the opportunity to present this paper.

#### Conflict of interest

The author declares that there is no conflict of interest related to this article.

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