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Closed–suction compared with Penrose drainage after free flap reconstruction in the head and neck

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Abstract

Microsurgical free flaps are common in head and neck reconstruction, and their techniques and outcomes have continuously improved during the past decades. However, there are variations in practice among surgeons between the use of closed-suction drainage systems and Penrose drains. The proponents of Penrose drains propose that the negative pressure generated by the closed-suction drainage system may harm the microvascular anastomosis. We know of no previous studies that have compared the two drains for microvascular free flap reconstruction, so our aim was to compare them in a single-centre, retrospective review of all patients who had microvascular free flap reconstruction of the head and neck region in our department between 1 November 2010 and 1 September 2017. During this period 84 patients had 87 free flap reconstructions in the head and neck, 43 of which had Penrose, and 44 closed-suction, drainage. We compared the number of complications between the groups including haematomas, seromas, wound infections, anastomostic thrombosis, anastomotic revision, and need for re-exploration. There were no significant differences between the groups, despite a trend toward fewer negative explorations in the closed-suction group. There were no differences in complications between suction and passive drainage systems after microvascular free flaps, which suggests that closed suction drainage could be safely used after free flap reconstruction in the head and neck.

Keywords: Microvascular reconstruction; Free flap; Drainage; Post-operative drainage; Penrose drain; Closed-suction drain

Introduction

Nowadays, microsurgical free flap reconstruction is used in day-to-day practice after resection of head and neck tumours.[1–3] The free flap technique enables the harvesting of a large amount of tissue, which can be tailored to reconstruct the defect while simultaneously permitting more extensive oncological resections.[1,4] Selection, techniques, and outcomes of free tissue transfer have continuously been improved and refined with experience gained in past decades.[1,3–5] Free flaps give potentially give higher success rates, better functional outcomes, and improved aesthetic results compared with other means of reconstruction.[1,2,4–7]

There are variations in practice among surgeons between the use of closed-suction drainage systems and Penrose drainage in the surgical neck wound when reconstructing the defect with free tissue transfer. Surgical drains are placed in dependent areas to prevent possible formation of seromas or early haematomas. Proper drainage after microvascular surgery is critical, because, if they form, seromas or hematomas may compromise the patency of the microvascu-

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lar anastomosis. The proponents of Penrose drains maintain that the negative pressure generated by the closed-suction drainage system may harm the microvascular anastomosis, and particularly cause the venous anastomosis to collapse.[8] The Penrose system drains passively by capillary action, and therefore cannot discharge highly viscous fluids; it also has the potential to introduce bacterial infection to the surgical site. The semirigid closed-suction drain, however, has a greater capacity to discharge viscous fluids and avoids passage of bacteria to the surgical site, but it is less pliable.[9,10] The Penrose drain drains over the neck, soils the patients and their surroundings, and (once removed) may leave an opening that could lead to an unsightly scar.[11] Although many surgeons use closed-suction drainage routinely after microvascular operations there is a lack of published evidence about their safety.

At our centre we have routinely used both Penrose and closed-suction drain systems. However, in the past few years we have moved to using mostly closed-suction drains in the neck unless the surgical dead space is small (for example, when a neck dissection was not required or when a patient was taken back to the operating theatre for exploration of the neck or revision of the microvascular anastomosis).

The purpose of this study was to compare the use of closed-suction with that of Penrose drains after microvascular free flap reconstruction in the head and neck. We hypothesised that the use of closed-suction drains is not associated with a higher rate of anastomotic compromise.

Patients, material, and methods

This is a retrospective analysis of the medical charts of all patients who had microvascular free flap reconstructions in the head and neck in our department from 1 November 2010 to 1 September 2017. The study was approved by the Sheba Medical Center Institutional Review Board and followed the guidelines of the Helsinki Declaration.

Most operations required a two-team approach. All free flaps were done by one surgeon supported by residents or senior head and neck surgeons. Penrose passive drains or Jackson Pratt closed-suction drains were used. Penrose drains were inserted at the line of incision, while Jackson Pratt closed drains were inserted through a separate stab incision below the original incision. The closed-suction drains were usually removed when less than 30 ml had drained in 24 hours/drain. There was no exact cut-off for the Penrose drains. Drains were left in longer in cases of flap dehiscence, or when there was a communication between the oral cavity and the neck.

Table 1
Patients' personal characteristics.

	Penrose (n = 43)	Closed-suction drainage (n = 44)	Total (n = 87)
Median (range) age	59 (16-75)	61 (26 -85)	61 (16 -85)
Male	21	22	43
Female	22	22	44

We compared the complication rate between the two groups including venous thrombosis, arterial thrombosis, formation of a haematoma or seroma, infection, dehiscence, need for debridement, and the incidence of salivary leaks. The complications were divided into major (defined by the need for re-exploration in the operating theatre) and minor (all others, that were treated conservatively).

Statistical analysis

Descriptive statistics were given as mean (SD), median, and range. The unpaired *t* test was used to compare the significance of differences between groups. Probabilities of less than 0.05 were considered significant. All analyses were made using IBM SPSS Statistics for Windows (version 25.0 IBM Corp).

Results

Eighty-four patients had 87 microvascular free flap reconstructions in the head and neck region during the time period stated (Table 1), and there were no significant differences between the two groups with respect to patients' age or sex. Only three flaps were lost (two in the closed-suction drain group and one in the Penrose drain group), and two patients had partial loss (both in the Penrose drain group). A Penrose drain was used in 43 of the operations and a closed-suction drain in 44.

Major complications (n = 12) are shown in Table 2, and there were no significant differences between the two groups. There were 27 patients with minor complications (Table 3) and again there were no significant differences between the groups. Nevertheless, there were more infections in the closed suction group, and in the Penrose group there were more haematomas that did not require re-exploration.

The number of re-explorations is listed in Table 4. The mean (SD) duration of placement of the Penrose drain was 7.2)(3.2) days and of the closed suction drainage group 6 (**2.6**)

Table 2
Major complications. Data are number of patients.

Group	No. of patients	Venous thrombosis	Arterial thrombosis	Arterial anastomotic tear	Haematoma	Infection	Dehiscence
Penrose	6	3	1	1	1	1	1
Closed suction drainage	6	4	0	1	2	1	1
Total	12	7	1	2	3	2	2

Table 3
Minor complications. Data are number of patients.

Group	No. of patients	Infection	Haematoma	Seroma	Debridment	Dehiscence	Salivoma
Penrose	13	4	4	0	3	8	0
Closed suction drainage	14	7	2	1	4	9	1
Total	27	11	6	1	7	17	1

Table 4
Numbers of re-explorations and revisions of microvascular anastomoses. Data are number of interventions.

	Positive exploration	White exploration	Revision
Penrose	6	3	4
Closed-suction drainage	6	0	4

Table 5
Mean (SD) days of drainage and duration of hospital stay in the two groups.

	Penrose	Closed-suction drainage	p value
Mean (SD) days of drainage	7.2 (3.2)	6 (2.6)	0.029*
Mean (SD) duration of stay in hospital	13.5 (11.1)	16.9 (11.9)	0.87**

*(t = 2.15, p = 0.029, df = 76); **(t = −1.37, p = 0.87, df = 85).

days, respectively (t = 2.15, p = 0.02981, df = 76) (Table 5). The mean (SD) duration of the postoperative hospital stay was 13.5(11.1) and 16.9 (11.9) days for the Penrose group and closed suction group, respectively (t = −1.37, p = 0.87, df = 85).

Discussion

Publications that compare the use of closed suction drainage with that of passive Penrose drainage to the neck are scarce. Our aim in the present study was to examine the safety of closed suction drainage in patients having microvascular reconstructions of the head and neck, and we found no significant differences in postoperative complications. There were three negative explorations in the Penrose group and none in the closed-suction drainage group, and the latter had their drains removed a day earlier. These results disprove the claims that closed-suction drains harm the patency of microvascular anastomoses.

Most studies published on the efficacy of prophylactic surgical drains referred to general surgery, appeared more than 30 years ago,[9,10,12] and suggested an increased risk of postoperative infections with the use of Penrose drains than with closed-suction drains.[9,10,12] Batstone et al compared passive and active drainage after neck dissection, and found poorer primary wound healing in the passive drainage group with no increase in the loss of free flaps when closed-suction drains were used.[11] Previous animal studies have shown that negative pressure generated by closed-suction drainage systems does not affect the patency of microvascular anastomoses.[13] Lauer et al used ultrasound to examine microvascular anastomoses in which closed-suction drains had been used, and found no change in the shape of the vessel lumen.[14]

Riaz et al described two patients in whom the anastomosed vessels were sucked into the suction drain, which might have happened because of displacement when the neck was moved. This is possible, particularly in free flap surgery in which there is a long vascular pedicle. To avoid displacement of the suction drains or vessels, therefore, we recommend that drains are carefully positioned away from the pedicle of the free flap, and secured properly. We therefore place the drains meticulously in dependent spaces away from, and never over, the anastomotic vessels.

Limitations of the present study include the bias inherent in any retrospective study, and a relatively small sample size. Nonetheless, both groups were distributed evenly in regards to type of drainage used and patients' details. We think that our results call for larger prospective randomised clinical trials with the aim of backing our routine for postoperative care after head and neck microvascular reconstruction with evidence-based data.

Conclusions

In conclusion, in this study we have shown that closed-suction drainage did not harm the patency of microvascular anastomoses and is not associated with an increased number of complications. The application of closed-suction drainage in microvascular free flap reconstruction should therefore be encouraged as it seems to be associated with fewer negative explorations, and a shorter duration of drainage.

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patients' permission

This study was a retrospective data analysis and did not required informed consent. Study protocol was approved by the Sheba Medical Center Ethics committee.

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