

Incidence of Wound Infection in Patients Undergoing Craniotomy: Influence of Type of Shaving

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Summary

How the method of shaving affects the incidence of deep post-operative wound infections was examined in 475 patients. It is shown that the rate of infection is not lower after wet shaving than after dry shaving. The overall infection rate was 4.2%, 2.9% in patients who had been shaved wet versus 5.5% in patients shaved dry. The difference is, however, not significant on the 5% level. With respect to dry shaving, the infection rate was not affected by whether the hair was removed with electric clippers alone (2.8%) or whether a disposable razor was also used for additional hair removal in the area of skin incision (3.2%).

Introduction

Although post-operative wound infection is a relatively harmless complication, it may nevertheless retard the healing process and thus prolong hospitalization. In general, a deep wound infection rate of 3–5% has to be expected after neurosurgical procedures, however, the figures given by various authors vary considerably^{2, 7, 10, 11, 16}. Studies on post-operative wound infections deal mostly with the antibiotic prophylaxis of such complications^{5–7, 9, 11–13}. To the best of our knowledge only a few reports exist in the general and neurosurgical literature on the influence of the method of hair removal^{3, 4, 8, 14, 15}. Although hair removal in patients undergoing neurosurgical procedures is usually performed by electric clipping followed by wet shaving, done either in the operating theatre immediately prior to surgery or on the ward the evening before¹⁷, there is one report which suggests that wet shaving is not necessary and it does not reduce the infection rate¹⁴. The objective of this study therefore was to determine the incidence of post-operative deep wound infections and whether this depended on the different types of hair removal.

Patients and Methods

Between 1982 and 1986, 475 patients in whom craniotomies had been performed at the Department of Neurosurgery, University of Freiburg, FRG, were examined for post-operative wound infection. Shunting procedures were excluded from this study. In 237 patients (49.9%), conventional wet shaves were performed in the operating room immediately prior to surgery. The hair had been electrically clipped on the ward the evening prior to surgery. In 238 patients (50.1%), hair was removed by electric clipping without wet shaving the evening prior to surgery. Of these 238 patients, 93 (19.6%) had been additionally dry-shaved with a disposable razor in the area of skin incision. This type of shaving was introduced to make the adhesive drapes on the scalp adhere better. In the remaining 145 patients (30.5%) of this group no additional skin preparation was carried out.

Post-operative wound healing was checked regularly for at least 2½ months after surgery. A deep wound infection was diagnosed if either a marked purulent reaction or a stubborn fistula with pathogens was present. In these cases, surgical wound revision with bone flap removal was performed. Not included for evaluation were superficial wound infections which required no wound revision.

The age and sex distributions are shown in Table 1. The mean age was 48 years in the wet-shaved and 50 years in the dry-shaved group. The age distribution shows highest rates in the 4th to 7th decades of life.

Craniotomy was mainly performed for tumour resection, *e.g.*, gliomas (33%), meningiomas (25%), and metastases (13%). Vascular repairs (10.3%) were less frequent indications for craniotomy. The diagnoses not further specified accounted for 4.2% (Table 2).

There were no major differences in distribution of sex, age, and diagnosis between the two groups (see Tables 1 and 2), nor in the location of trephination (Table 3) or operative procedure (Table 4).

Results

In 20 of 475 patients, surgical wound revision was required because of deep wound infection, making an overall infection rate of 4.2%. Thirteen of these patients (5.5%) belonged to the wet-shaved group. The other 7

Table 1. *Distribution of Age and Sex*

Type of hair removal	Number of operations	Sex		Age (years)										Average age in years
		male number (%)	female number (%)	0-10 number (%)	11-20 number (%)	21-30 number (%)	31-40 number (%)	41-50 number (%)	51-60 number (%)	61-70 number (%)	71-80 number (%)			
Wet	237	130 (54.9)	107 (45.1)	10 (4.2)	8 (3.4)	21 (8.9)	26 (11.0)	26 (11.0)	51 (21.5)	57 (24.0)	50 (21.1)	14 (5.9)	48	
Dry: total	238	118 (49.6)	120 (50.4)	5 (2.1)	5 (2.1)	16 (6.7)	26 (10.9)	26 (10.9)	62 (26.1)	58 (24.4)	49 (20.6)	17 (7.1)	50	
Dry: electric hair clippers alone	145	78 (53.8)	67 (46.2)	1 (0.7)	2 (1.4)	9 (6.2)	18 (12.4)	18 (12.4)	35 (24.1)	39 (26.9)	32 (22.1)	9 (6.2)	50	
Dry: electric hair clippers and disposable razor	93	40 (43.0)	53 (57.0)	4 (4.3)	3 (3.2)	7 (7.5)	8 (8.6)	8 (8.6)	27 (29.1)	19 (20.4)	17 (18.3)	8 (8.6)	50	
Total	475	248 (52.2)	227 (47.8)	15 (3.2)	13 (2.7)	37 (7.8)	52 (11.0)	52 (11.0)	113 (23.8)	115 (24.2)	99 (20.8)	31 (6.5)		

Table 2. *Diagnosis*

Type of hair removal	Number of operations	Tumour		Vascular repair					Other craniotomies number (%)	
		glioma number (%)	meningioma number (%)	metastasis number (%)	acoustic neuroma number (%)	other number (%)	aneurysm number (%)	angioma number (%)		IC-EC bypass number (%)
Wet	237	69 (29.1)	66 (27.9)	26 (11.0)	10 (4.2)	27 (11.4)	15 (6.3)	4 (1.7)	9 (3.8)	11 (4.6)
Dry: total	238	88 (37.0)	54 (22.7)	38 (16.0)	11 (4.6)	17 (7.1)	9 (3.8)	6 (2.5)	6 (2.5)	9 (3.8)
Dry: electric hair clippers alone	145	54 (37.2)	28 (19.3)	26 (17.2)	5 (3.5)	9 (6.2)	9 (6.2)	2 (1.4)	6 (4.2)	7 (4.8)
Dry: electric hair clippers and disposable razor	93	34 (36.6)	26 (27.9)	13 (13.9)	6 (6.5)	8 (8.6)	—	4 (4.3)	—	2 (2.2)
Total	475	157 (33.0)	120 (25.3)	64 (13.5)	21 (4.4)	44 (9.3)	24 (5.0)	10 (2.1)	15 (3.2)	20 (4.2)

Table 3. Location of Trephination

Type of hair removal	Number of operations	Trephination					
		frontal number (%)	temporal number (%)	pterional number (%)	parietal number (%)	occipital number (%)	suboccipital number (%)
Wet	237	36 (15.2)	30 (12.7)	63 (26.6)	40 (16.9)	18 (7.6)	50 (21.0)
Dry: total	238	40 (16.8)	35 (14.7)	50 (21.0)	57 (24.0)	20 (8.4)	36 (15.1)
Dry: electric hair clippers alone	145	24 (16.6)	24 (16.6)	31 (21.3)	37 (25.5)	11 (7.6)	18 (12.4)
Dry: electric hair clippers and disposable razor	93	16 (17.2)	11 (11.8)	19 (20.4)	20 (21.5)	9 (9.7)	18 (19.4)
Total	475	76 (16.0)	65 (13.7)	113 (23.8)	97 (20.4)	38 (8.0)	86 (18.1)

Table 4. Operation Procedure

Type of hair removal	Number of operations	Craniotomies		Acrylic cranioplasty number (%)
		osteoplastic number (%)	osteoclastic number (%)	
Wet	237	218 (92.0)	16 (6.7)	3 (1.3)
Dry: total	238	229 (96.2)	7 (2.9)	2 (0.9)
Dry: electric hair clippers alone	145	139 (95.9)	5 (3.4)	1 (0.7)
Dry: electric hair clippers and disposable razor	93	90 (96.8)	2 (2.1)	1 (1.1)
Total	475	447 (94.1)	23 (4.8)	5 (1.1)

patients (2.9%) had only dry hair removal at the operation site. In these 7 patients, 4 surgical wound revisions (2.8%) were necessary after the use of the electric hair clippers alone. Three deep wound infections occurred (3.2%) in the group with additional dry shaving in the area of the incision (Table 5).

Discussion

The overall incidence of deep surgical wound infections in our department is 4.2% and thus correlates with the results of other studies^{2, 7, 10, 11}. The rate of infection in the group of exclusively dry-shaved patients is clearly lower than in wet-shaved patients (2.9% versus 5.5%). These differences, however, are not statistically significant at the 5% level. In the group of patients shaved dry, the infection rates were the same regardless of whether the hair was removed by electric

clipping only or if additional dry shaving in the area of skin incision was performed (2.8% and 3.2%, respectively).

Table 5. Deep Wound Infections Requiring Operative Revision Related to Type of Hair Removal

Type of hair removal	Number of operations	Deep infections number	(%)
Wet	237	13	5.5
Dry: total	238	7	2.9
Dry: electric hair clippers alone	145	4	2.8
Dry: electric hair clippers and disposable razor	93	3	3.2
Total	475	20	4.2

Cruse and Foord⁴, who examined 18,090 surgical wounds in general surgery, observed an infection rate of 2.3% in wet-shaved patients as opposed to 1.7% in patients in whom the operation site was prepared by electric hair clipping only. In cases where no hair was removed, the authors found an infection rate of 0.9%. Similar results in general surgery were reported by Seropian and Reynolds¹⁵ and Court-Brown³. Scherpérel¹⁴ *et al.* found an infection rate of 0.6% in 1,000 craniotomies in which hair was removed only in the area of the skin incision.

As previously mentioned these reports and our results suggest that wet shaving does not reduce the risk of deep post-operative wound infection. For a more exact statistical analysis, other factors must be studied that may affect the occurrence of post-operative wound infections, such as primary disease, immunosuppressive factors, duration of operation, post-operative course, additional draining and shunting procedures, as well as other infectious complications following surgery. This study was designed for the purpose of evaluating a general tendency only. As regards to better adhesiveness of the adhesive drapes on the scalp, electric hair clipping and additional dry shaving with a disposable razor in the area of skin incision only seems to be the safest method of pre-operative hair removal.

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