

Cosmesis in Neurosurgery: Is the Bald Head Necessary to Avoid Postoperative Infection?

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Abstract

Aim: The aims of this study were to prospectively investigate the incidence of postoperative wound infection following elective cranial surgery, when scalp hair removal was limited to the line of the incision, and to see if there was an increased risk of infection. **Materials and Methods:** This is an observational study of 57 consecutive adult elective cases operated upon without head shave (between July 1998 and December 1998). The method of scalp preparation is described. **Results:** During the follow-up period, there was 1 case (1.75%) of postoperative wound infection. This was compared with retrospective data, and was not found to be statistically significant. **Discussion:** In a review of earlier studies and a search into the history of aseptic surgery, no scientific ground for the practice of shaving was found. We suggest that there is no advantage in shaving patients in terms of reducing wound infection rates.

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Key words: Observational study, Shaving, Wound infection

Introduction

Preoperative shaving for cranial neurosurgical procedures, as recommended in textbooks, is still a traditional practice in Singapore. Hair has been associated with uncleanliness and its removal, particularly by shaving, has been associated in the minds of practitioners and the public with cleanliness and reducing the risk of infections. Compared with other surgical disciplines, the practice is probably more established in the field of neurosurgery. Is there, however, a scientific basis for this? The rationale for the practice dates back to the dictums laid down by Harvey Cushing,¹ the founding father of modern neurosurgery. Our understanding of the pathogenesis of wound infection has vastly increased since Cushing's time. Over the recent decades, it has been shown repeatedly that preoperative skin shave does not offer any protection against wound sepsis. On the contrary, it seems to be associated with a higher risk of wound infection.²⁻⁵ In addition, by mutilating the body image of the patient, it causes psychological trauma⁶ and delays rehabilitation. The authors feel that the practice is no longer justifiable on scientific grounds. This is the first review of shaving and its relation to wound infection among neurosurgical patients locally.

Aims

The aims of this observation study were to prospectively investigate the incidence of postoperative wound infection following cranial surgery, when scalp hair removal is limited to the line of incision, and to see whether it increases the risk of surgical infection.

Materials and Methods

A series of 57 consecutive patients undergoing a variety of elective cranial neurosurgical procedures were recruited into this observational study (between July 1998 and December 1998). All the patients were adult neurosurgical patients. All the wounds were clean according to the definition of the American National Research Council⁷ criteria (Table I). Apart from the preoperative scalp preparation there was no deviation from the usual performance of the operations. All patients received a single preoperative dose of prophylactic intravenous antibiotics (usually cefazolin 2 g).

After induction of anaesthesia and positioning the patient on the operating table, the hair was parted along the line of the incision with a comb and the surgical incision was marked on the scalp with a permanent marker. Scalp hair

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TABLE I: CLASSIFICATION OF WOUNDS

Clean wound	Non-traumatic No inflammation encountered No break in aseptic technique Respiratory, alimentary, genitourinary or oropharyngeal tract not entered
Clean-contaminated wound	Alimentary, respiratory or genitourinary tracts entered under controlled conditions and without unusual contamination Appendectomy Oropharynx entered Vagina entered Genitourinary tract entered in absence of culture-positive urine Biliary tract entered in absence of infected bile Minor break in technique
Contaminated wound	Major break in technique Gross spillage from gastrointestinal tract Open, fresh traumatic wounds Entrance of genitourinary or biliary tracts in presence of infected bile or urine Incisions in which acute non-purulent inflammation is present
Dirty wound	Acute bacterial inflammation with pus encountered during surgery Traumatic wound with retained devitalised tissue, foreign bodies, faecal contamination and/or delayed treatment or from dirty source Perforated viscus encountered

removal was limited to 3 mm on either side of the planned incision by using the point of an electric clipper. The whole head was then given serial shampoos using cetrimide, hibiscrub and povidone iodine.

The hair was kept away from the incision by the use of iodine-impregnated gauze fixed with staples. After the operation was completed, the incision was closed in the usual fashion in two layers using vicryl subcutaneously and staples for the skin. Aureomycin cream was applied to the line of the incision. No dressings were applied. The wounds were left exposed on the ward postoperatively. The usual clinical surveillance for postoperative wound infection was followed in all cases (Figs. 1 to 3).

For comparison, a retrospective review of infection rates for elective cranial surgery in our department was done for the period January 1998 to June 1998. This was the period prior to this study where scalp hair removal by electrical clippers involved a wide area beyond the incision.

The Fisher's exact test was used to test the significance between the 2 groups.

Results

A total of 57 patients were recruited into the study. The patients characteristics are shown in Table II.

Twenty-four patients were on medium to long-term

TABLE II: CHARACTERISTICS OF THE PATIENTS

Characteristic	No.
Age (y)	
20-40	11
40-60	30
60 and above	16
Sex	
Male	26
Female	31
Craniotomy (total)	20
Meningioma	7
Aneurysm	6
Glioma	3
Metastases	4
Burr hole procedures (total)	34
Chronic subdural haematoma	20
Stereotactic biopsy	10
Cranial endoscopy	3
Intraventricular intracranial pressure monitor	1
Other procedures (total)	3
Metallic cranioplasty	2
Ventriculo-peritoneal shunt	1

courses of dexamethasone pre- and postoperatively. These patients were at increased risk of having wound breakdown/infection because of the effect of steroids on wound healing.

There were no cases of postoperative wound infection at the time of stitch removal in 56 (98.2%) out of the 57 patients at the 6 weeks' follow-up.

One patient (1.75%), who had a large meningioma resected, was found to have a small (5 mm) focal wound breakdown of a bicoronal incision from a stitch abscess at 1-month follow-up. She had been on steroids for a total of 7 days. This fits the technical definition of a superficial incisional surgical site infection (SSI), according to the criteria set by the Center for Disease Control (CDC)⁸ (Table III).

In our series, therefore, there was a wound infection rate of 1.75%. This is comparable with other studies (Tables IV and V).

The review of cases prior to this study revealed an infection rate of 2.36% from a total of 127 elective operations.

This was found to be statistically not significant ($P = 1.0$), suggesting that it is safe to limit hair removal to the incision line.

Discussion

Despite major advances in infection control in the first half of the twentieth century, surgical wound infection persisted and still remains a problem of sufficient magnitude for researchers to continue the search for ways of



Fig. 1. Preoperative scan of a right temporal tumour.



Fig. 2. Postoperative scan of a right temporal tumour.

overcoming it. A growing number of workers over the last three decades have investigated the relationship between hair removal and wound sepsis. Cruse and Foord⁹ conducted a 5-year (commencing in September 1967) prospective study of 23,640 surgical wounds in Calgary, Alberta, Canada. The objective was to establish the rate of wound infection and determine the factors that influence its rate. The results in relation to preoperative hair removal were

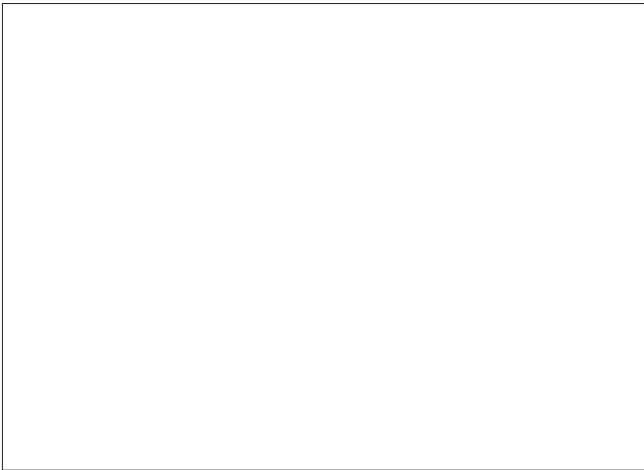


Fig. 3. Postoperative appearance with hair removal limited to line of incision.

TABLE III: DEFINITION AND CHARACTERISATION OF SURGICAL SITE INFECTION (SSI)

Superficial Incisional SSI Infection occurs within 30 days after operative procedure and involves only skin or subcutaneous tissue of the incision and at least one of the following is present: • Purulent discharge from the superficial incision • Organisms isolated from an aseptically-obtained culture of fluid or tissue from the superficial incision • At least one of the following signs and symptoms of infection: pain or tenderness, localised swelling, redness or heat and superficial incision is deliberately opened by surgeon • Diagnosis of superficial incisional SSI by the surgeon or attending physician
Deep Incisional SSI Infection occurs within 30 days after operative procedure and involves deep soft tissue of the incision and at least one of the following is present: • Purulent discharge from the deep incision • The deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs and symptoms: fever (>38°C) or localised pain or tenderness, unless incision is culture negative. • An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation or by histopathologic or radiologic examination • Diagnosis of a deep incisional SSI by the surgeon or attending physician
Organ/space SSI Infection occurs within 30 days after operative procedure, appears to be related to the operative procedure and involves any part of the anatomy other than the incision opened or manipulated during the operative procedure and at least one of the following is present: • Purulent discharge from a drain that is placed through a stab wound into the organ/space • Organisms isolated from an aseptically obtained culture fluid or tissue in the organ/space • An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation or by histopathologic or radiologic examination • Diagnosis of an organ/space SSI by the surgeon or attending physician

TABLE IV: STUDIES INVESTIGATING THE RELATIONSHIP OF PREOPERATIVE HAIR REMOVAL AND WOUND INFECTION IN ALL SURGICAL DISCIPLINES

Study	Year published	Total no. of patients	Wound infection after shaving	Wound infection after using a depilatory	Wound infection after clipping	Wound infection with no hair removal
Seropian & Reynolds ¹⁰	1971	561	5.6%	0.6%	—	0.6%
Cruse & Foord ⁹	1973	15,389	2.3%	—	1.7%	0.9%
Court-Brown ⁷	1981	404	12.4%	7.9%	—	7.8%
Bird et al ¹¹	1984	—	2.9%	—	—	1.5%
	1990	702	Shaving found to have a statistically significant association with the development of wound infection			
Moro et al ¹²	1996	2262	Shaving found to be associated with an increased risk of wound infection			

TABLE V: STUDIES INVESTIGATING THE INCIDENCE OF WOUND INFECTION AFTER NO PREOPERATIVE HAIR REMOVAL IN NEUROSURGERY

Study	Year published	Type of cases	Total no.	Wound infection rate (%)
Winston ²	1992	Craniocervical	313	0.3
		CSF diversion	218	2.8
Scherpereel ¹³	1993	Craniocervical only	4655	0.43
Lim et al ¹⁴	1994	Bicoronal incisions	60	3.3
Braun & Richter ³	1995	Craniocervical	57	0
Siddique et al ¹⁵	1998	Craniocervical	105	0.95

CSF: cerebrospinal fluid

surprising. In 15,389 clean wounds, patients that were shaved had an infection rate of 2.3%. In patients who had their hair clipped, the infection rate was 0.9%. Seropian and Reynolds¹⁰ in their prospective randomised study of 406 patients in New York, from 1968 to 1969, found the infection rate to be 5.6% with shaving and 0.6% without shaving. Furthermore, in patients in whom a depilatory cream was used instead of shaving, the infection rate was also 0.6%. However, the 2 groups were not evenly matched, in that more contaminated and dirty wounds were from the shaved group, which may have contributed to the large difference of SSI. Court-Brown⁷ carried out a prospective trial in Edinburgh and found the infection rate to be 12.4% with shaving and 7.8% without shaving. Studies conducted by Bird et al¹¹ and Moro et al¹² also revealed similar findings with higher rates of infection following shaving than without shaving.

Scanning electron micrographs of shaved skin showed that surfaces that appeared undamaged to the naked eye had sustained multiple epidermal injuries.¹⁶ The razor caused multiple slices perpendicular to the line of progress of the blades.

These injuries potentially liberate the resident flora to the operative field and provide access and substrate for

transient micro-organisms,¹⁰ leading to an increased risk of wound infection.

The Center for Disease Control (CDC) of the US Department of Health published *Guidelines for Prevention of Surgical Wound Infections*.¹⁷ The guideline was originally published in 1982, but was revised in 1985 in order to incorporate three major changes, one of which as stated in the preface to the guideline was that “Recommendations for preoperative removal of hair have been modified to emphasize clipping rather than shaving, if hair removal is necessary”.

Recommendations of Current Surgical Textbooks

- “... Shaving the operative site increases the rate of wound infection in all type of surgery”—The New Aird’s Companion in Surgical Studies, 2nd edition, 1992¹⁸
- “Numerous studies have now demonstrated that pre-operative shaving significantly increases postoperative wound infections. When the operation site is heavily overgrown with hair, this should be removed with barbers clippers or depilatory creams.”—Royal College of Surgeons of England, Course Manual for Clinical Surgery in General, 1993¹⁹
- “Shaving is probably not indicated in most patients”—Oxford Textbook of Surgery, 1994, page 31²⁰
- “Hair removal is aesthetic for surgical procedures and allows later removal of skin and wound dressing less painfully but, for many, the procedure is unnecessary. When shaving breaks the skin, the raw surface is soon colonised by resident and soon pathogenic flora, and presents a higher risk of postoperative infection, either in the wound or in the deeply-placed prosthesis or graft”—Surgical Management, 2nd edition, 1991²¹

It had been our practice to perform intraoperative shaving using a razor up to 5 years ago. This occasionally caused gross cuts, razor nicking, and epidermal lacerations with multiple bleeding points, with the potential problems alluded

to earlier. We started using electrical clippers, which afforded a close shave, with none of the problems above, but it still resulted in large bald spots. Therefore, we wanted to see if leaving a full head of hair and limiting hair removal to the line of incision was safe.

This study shows that hair preservation in cranial neurosurgical procedures does not predispose to increased infection rates in the local population. The main issues that had to be addressed during this study were:

1. The introduction of a novel method of hair preparation in our neurosurgical theatre. However, the theatre nurses were able to adapt to this and make some valuable suggestions. The nurses on the ward in managing the wound postoperatively also initially expressed a similar reservation. However, the initial problems have been overcome with increased familiarity and the usual nursing ingenuity.
2. The use of scalp shampoos delayed the start of the operation initially by about 20 minutes. This preparation time has been reduced to 5 minutes now. The hair preservation did not otherwise impede the performance of a successful operation in any way. Scalp closure is a little delayed by the need to keep the hairs out of the incision, but this is not more than an extra 5 to 10 minutes in the longest scalp incisions.

In view of the slight delay to the start of the operation that this variation in scalp preparation induces, it was not considered to be appropriate for neurosurgical emergencies, where speed is of essence and also it is advocated that scalp hair is removed in order to permit thorough examination before surgical treatment. Failure to disclose and treat a small compound head wound that proceeds to intracranial infection is too high a price to pay for the cosmetic benefits of retention of all scalp hair.

Patients and their families have uniformly expressed gratitude and satisfaction at the bonus of a full head of hair, to an operation well done.

Conclusion

This study supports the notion that skin, including the scalp, can be prepared safely for neurosurgical procedures without removing the hair. There does not seem to be any sound scientific basis for the practice of preoperative skin shaving. Many studies have now shown that the practice is not necessary for prevention of wound sepsis. It may, in fact, paradoxically be increasing the risk of infection owing to epidermal injury. In addition, especially in neurosurgery, it is a psychologically traumatic experience. The practice should therefore be used selectively.

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