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Journal of Medical Case Reports and Case Series ISSN: 2692-9880

Case Series

Volume 5 Issue 13

Primary Closure of Scalp Abscesses Following Surgical Drainage Versus Healing Via Secondary Intention: A Retrospective Patient Series

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Received date: 27 September 2024; **Accepted date:** 14 October 2024; **Published date:** 17 October 2024

Citation: Feng QJ, Long IJ, Lim SL, Sun IS, Wen Low S, et al. (2024) Primary Closure of Scalp Abscesses Following Surgical Drainage Versus Healing Via Secondary Intention: A Retrospective Patient Series. J Med Case Rep and Case Series 5(13): https://doi.org/10.38207/JMCRCS/2024/OCT051303123

Abstract

Background: Scalp abscesses are commonly treated with incision and drainage (I&D) followed by secondary intention healing, often resulting in delayed healing, scarring, and frequent dressing changes. Primary closure following I&D has shown success in other anatomical regions, but its use for scalp abscesses is underreported. Given the scalp's unique vascularity, we hypothesize that primary closure may offer better outcomes.

Method: A retrospective review of 17 patients over five-years was conducted. Patient outcomes analyzed include length of hospital stay, post-operative complications, follow-up visits and recurrence.

Results: Of the 17 patients, 7 underwent primary closure, and 10 underwent secondary healing. Most had poorly-controlled diabetes mellitus. No significant differences were observed between the groups, but primary closure had shorter hospital stays (1.7 vs 3.6 days) and fewer post-operative visits (4.14 s 6.67). No major complications occurred. One abscess recurred in a diabetic patient who underwent primary closure.

Conclusion: Recurrence of surgically treated abscesses is a known complication. Primary closure is non-inferior compared to healing via secondary intention for surgically treated scalp abscesses.

Keywords: Scalp abscess, incision and drainage, primary closure, secondary intention healing, wound healing

Introduction

An abscess is a collection of pus that has accumulated within tissue, in response to an inflammatory process caused by an infectious process or foreign material. Standard treatment options for subcutaneous and soft tissue abscess include antibiotic therapy, repeated percutaneous aspiration or incision and drainage (I&D) **[1]**. Among these, I&D followed by healing via secondary intention remains the preferred choice for most abscesses, as it prevents the accumulation of infective material within an enclosed space and allows for free drainage of pus while the wound heals **[2]**. This however, leaves a noticeable scar, delays wound healing, and necessitates frequent, painful dressing changes **[2]**.

This long-held dogma was first challenged by Ellis in 1951 who proposed that primary closure following I&D and removal of abscess wall was feasible, as antibiotics could penetrate the abscess cavity **[3]**. Primary closure offers several advantages, including faster healing, shorter hospital stays, and better cosmetic outcomes **[2]**. The primary closure technique is well supported in breast, anorectal and axillary abscesses **[1,4-5]**, but there is a paucity of literature for primary closure of scalp abscesses. The current accepted practice for surgical management of scalp abscesses follows that of subcutaneous and soft tissue abscesses, which is incision and drainage followed by healing via secondary intention **[9]**.

The scalp is a unique anatomical structure characterized by its high vascularity with a rich array of anastomoses that cover the complete blood supply to the scalp **[6]**. This is especially favorable for wound healing, allowing patients to reduce the number of post-operative clinic visits for wound inspection and dressing. Additionally, this would also avoid unwanted side effects of healing via secondary intention such as hair loss and unsightly scars. We hypothesize that primary closure following I&D of scalp abscesses may be superior to healing via secondary intention. This case series documents our protocol – diagnostic evaluation, surgical intervention, post-operative care and outcomes observed in a cohort of patients treated at our institution.

Methods

This retrospective cases series comprises 17 patients diagnosed with scalp abscesses treated by the Neurosurgical department between January 2019 and August 2024 at the Ng Teng Fong General Hospital, Singapore.

The inclusion criteria encompassed adult patients over the age of 18, who underwent incision and drainage of scalp abscesses. All wounds were classified as infected under the Centre for Disease Control classification **[7]**. Pregnant women, children, and patients with deep-seated infections, or medications affecting wound healing such as long-term steroids or immunosuppressants were excluded from the study. Each patient underwent a thorough clinical evaluation and were counselled on all management options (including conservative management with antibiotic therapy alone) prior undergoing surgery. Patients had their glycated hemoglobin (HbA1C) checked, and were placed on a course of prophylactic amoxicillin and clavulanic-acid as per our local guidelines for skin and soft tissue infection. Post-operative antibiotic choice was guided by intraoperative wound cultures and sensitivities (C+S). Collected data was analyzed to look for statistical significance, defined as a P-value of < 0.05.

Surgery was carried out under general or monitored anesthesia care by our institution's neurosurgeons. The skin was prepared with 10% povidone-iodine solution, draped, and an incision was made over the most fluctuant area of the abscess. Pus was collected for C+S. All loculi was broken down digitally, and necrotic tissue (if any) was excised. The abscess cavity was irrigated with chlorhexidine, diluted hydrogen peroxide and sterile saline. The choice of closure method was determined intraoperatively based on the wound condition.

Primary Closure:

Wound closure was achieved by approximating the wound in layers – Vicyl (2/0 or 3/0) sutures to subcutaneous layers, and Prolene (3/0 or 4/0) sutures to skin. Careful attention was given to the depth and tension of the sutures to minimize the risk of ischemia or dehiscence.

Secondary Intention:

The cavity was packed with chlorhexidine-soaked sterile gauze. The head would be loosely wrapped with a bandage to keep the packing within the wound. In some cases, skin was loosely tagged with Prolene sutures.

Standard post-operative care included pain management with oral analgesics, continued antibiotics, and scheduled wound inspection on day 3 or prior home, whichever was earlier. Patients would be discharged home when ready.

Primary Closure:

Wound assessment and suture removal was arranged in our outpatient clinic.

Secondary Intention:

Patients were followed up with their local primary care institution (polyclinics or general practitioner) for regular wound inspection and dressing change. Progress was reviewed in our outpatient clinic.

Results

Table 1: Characteristics of study patients

No	Age (years)	Sex	Closure	Location and size	Significant PMH	HbA1c	Wound culture	Antibiotics	Post-op length of stay (days)	STO (POD)	Discharged from NES POD (total visits)	Complications
1	37	M	Primary	Vertex 3 x 2 cm	DM, Previous scalp abscesses	7%	No growth	Augmentin	2	9	9 (1 visit)	No
2	49	F	Primary	Occipital-parietal 4 x 4 cm	Ventral-septal defect	4.8%	S. aureus	Augmentin	1	8	8 (1 visit)	No
3	71	M	Primary	Left temporal 1.7 x 2.3 cm	DM, Liver cirrhosis with bi-cytopenia	8.2%	MSSA	Augmentin, Cefazolin	3	12	19 (3 visits)	No
4	40	F	Primary	Occipital 2 x 3 cm	DM	9.9%	S. aureus	Augmentin	2	10	10 (1 visit)	No
5	19	M	Primary	Left parietal 3 x 3 cm	None	4.8%	No growth	Augmentin	1	11	16 (5 visits)	No
6	60	F	Primary	Right parietal ~ 5 x 5 cm	DM	6.4%	MRSA	Vancomycin, Linezolid	2	13	18 (16 visits)	No
7	55	M	Primary*	Occipital 5 x 5 cm	DM	13.6%	S. aureus	Augmentin	1	9	9 (2 visits)	No
8	58	M	Secondary	Left parietal 3 x 2 cm	DM	7.1%	S. aureus	Augmentin	1	N/A	20 (12 visits)	No

9	41	F	Secondary	Vertex 3 x 2 cm	DM, Previous scalp abscesses	14.6%	S. aureus	Cloxacillin	3	16	16 (5 visits)	No
10	75	M	Secondary	Occipital 5 x 3 cm	DM, AF on apixaban	>14%	MSSA	Augmentin	4	N/A	26 (4 visits)	No
11	51	F	Secondary	Left temporal 3 x 2 cm	DM	9.7%	S. aureus	Augmentin	3	N/A	14 (3 visits)	No
12	48	M	Secondary	Vertex 5 x 5 cm	DM, Abscesses on thorax and limbs	10.4%	S. aureus	Augmentin	1	N/A	Patient DNA	No
13	65	M	Secondary	Occipital 2 x 2 cm	DM	10.1%	S. aureus	Augmentin	4	N/A	16 (4 visits)	No
14	56	M	Secondary	Occipital 3 x 4 cm	DM, Previous scalp abscesses	13.6%	S. aureus	Augmentin	6	16	16 (12 visits)	No
15	33	M	Secondary	Vertex 2 x 3 cm	Previous craniotomy for astrocytoma	4.8%	No growth	Augmentin	9	N/A	17 (3 visits)	No
16	80	M	Secondary	Right temporal 2 x 2 cm	N/A	5.8%	S. aureus	Augmentin	3	N/A	50 (10 visits)	No
17	51	M	Secondary	Occipital 3 x 4 cm	DM, History of thorax, back and scrotal abscesses	>14%	No growth	Augmentin	2	N/A	19 days (7 visits)	No

Legend: M = Male, F = Female. PMH = Past Medical History, DM = Diabetes Mellitus, AF = Atrial Fibrillation. MRSA = Methicillin Resistant S. Aureus, MSSA = Methicillin Susceptible S. Aureus. POD = Post-operative day. DNA = Did not attend follow-up appointment

* Patient also had a drain inserted, removed post-operative day 1

Patient 7 and 14 are the same patient i.e. recurrence of scalp abscess

Seventeen patients were identified for review – 12 males (71%) and 5 females (29%). 7 patients underwent primary closure, and 10 via healing with secondary intention. A majority of our patients were middle aged (mean age of 52.1 years) with a background significant for sub-optimal control of diabetes mellitus (defined as HbA1c >7.1%). Wound swabs were mostly positive for Staphylococcus aureus that were susceptible to Augmentin.

Table 2: Comparison between both groups

Characteristics	**Primary Intention (n=7)**	**Secondary healing (n=10)**	**P-value**
Average age in years (range)	47.3 (19-71)	55.8 (33-80)	0.285
Gender (Male: Female)	4:3	8:2	0.309
Mean size of abscess in cm^2 (range)	12.99 (3.9-25)	9.6 (4-25)	0.385
Average HbA1C* (range)	7.81% (4.8%-13.6%)	10.41% (4.8%-14%)	0.146

* HbA1c taken as 14.5% for those with readings >14%

Table 3: Location of abscesses

Location	**Primary Intention (n=7)**	**Secondary healing (n=10)**
Vertex	1	3
Occiput	3	4
Temporal	1	2
Parietal	2	1

Table 4: Post-operative findings in both groups

Parameter	Primary Intention (n=7)	Secondary healing (n=10)	P-value
Average post-op Hospital stay in days (range)	1.71 (1-3)	3.6 (1-9)	0.066
Average number of post-op clinic visits * (range)	4.14 (1-16)	6.67 (3-12)	0.289
Recurrence (absent: present)	6:1	10:0	0.853

* There was one patient who did not attend follow-up, and was excluded from the analysis for this parameter

Statistical analysis was carried out using appropriate tests (Student's t-tests and Chi-square test). Propensity score matching, patient stratification was not done in view of the low patient numbers. Both groups were comparable in terms of age, gender, abscess size, HbA1c.
Wound healing is a complex process involving four distinct stages – hemostasis, inflammation, proliferation and maturation **[8]**. Various factors influence wound healing, which broadly can be characterized as either local or systemic – local factors include wound location, blood supply, infection, contamination and radiation damage; systemic factors include increasing age, co-morbidities (anemia, diabetes, reduced immunity), nutritional deficiency and obesity.
There was no difference between the average length of stay and the average number of post-operative visits.

Discussion

The conventional treatment of cutaneous abscesses involves I&D followed by healing via secondary intention **[9]**. This occurs when the wound heals from the bottom of the wound upwards. Although primary and secondary intention follow the same stages, primary intention is faster as the dermal edge is opposed throughout the process. The sutured wound also provides a physical barrier against environmental pathogens, reducing the risk of infection.
Additionally, primary closure offers better cosmetic outcomes, less pain, and greater patient comfort due to aligned and stabilized wound edges **[10]**.

In our case series, we note that there was no significant statistical difference between both groups. No complications were reported. Many of these patients had poor long-term glycemic control, but this did not result in differences in outcomes between primary closure and healing via secondary intention. The primary group was noted to have slightly larger abscesses on average but there was no significant difference. Abscesses are most commonly seen on the occiput for both groups. There was one recurrence observed in one patient with a history of diabetes, but otherwise was no clear relationship between the closure type, wound size, length of stay and average number of post-discharge visits. Diabetes mellitus is a known risk factor for impaired wound healing due to multiple pathophysiologic factors such as vascular, neuropathic, immune function and biochemical abnormalities **[11].** However, due to our limited sample size, we are unable to link diabetes mellitus as an independent factor for the recurrence in our one patient who underwent initial primary closure. Additionally, recurrence of abscesses may occur in either group **[9]**, and patients should be appropriately counselled on this whilst being consented for surgery.

Our experience suggests that ceteris paribus, primary closure of scalp abscesses is non-inferior to healing via secondary intention. We postulate that this is due to the highly vascular nature of the scalp which allows for specialized cells to be transported quickly to the wound. Its abundant blood supply also reduces ischemic complications associated with excessive tension in wound closure in contrast to other regions of the body. The simplicity of the procedure, coupled with a low incidence of complications, suggests that primary closure is non-inferior compared to healing via secondary intention, even in patients with diabetes mellitus.

Limitations of this paper include a small sample size with short follow up time. There is an absence of longitudinal data such as patient satisfaction, overall healing time, which could provide a more comprehensive picture of patient recovery. There was no randomization of patients into primary or secondary healing groups, which could lead to selection bias. Lastly, the specific surgical technique used for closure or management abscesses were not discussed. Differences in surgical skill, wound management protocols or adjunctive therapies could impact healing outcomes but are not accounted for in this study.

Conclusion

Although the small sample size limits the power of our conclusions, trends suggest that primary closure reduces post-operative healthcare visits, length of hospital stay, with no increase in complications. We propose that primary closure of infected scalp wound facilitates faster healing due to the highly vascular nature of the scalp. Our findings advocate for the continued application of this technique in clinical practice. This paper serves as a small pilot study, which may be useful for future prospective studies with larger cohorts to validate these results, and to explore the long-term outcomes associated with primary closure techniques in scalp surgery.

Acknowledgments

We would like to thank Dr Tan Chin Lik and Dr Aaron Foo for contributing their patients for this project.

Author contributions

QJF authored the manuscript, collected and analyzed the data. IJL collected data and reviewed the manuscript. SLL, ISS, SLL reviewed and edited the manuscript. CPG conceptualized and oversaw the project.

Funding and Competing Interests:

No funding, grants, or other support was received for this project. The authors do not have any conflicts of interest to declare.

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