Case report

Iatrogenic pseudoaneurysm of the superficial temporal artery following craniectomy from a scalp hook retractor penetrating injury: Case report and literature review

Hong-Xiang Zheng\textsuperscript{a}, Yao-Lin Lee\textsuperscript{a}, Guan-Yu Chen\textsuperscript{a}, Yi-Chieh Hung\textsuperscript{a,b,}\textsuperscript{*}

\textsuperscript{a} Department of Neurosurgery, Chi-Mei Medical Center, Tainan, Taiwan
\textsuperscript{b} Department of Recreation and Healthcare Management, Chia Nan University of Pharmacy and Science, Tainan, Taiwan

ARTICLE INFO

Keywords:
Pseudoaneurysm
Superficial temporal artery
Iatrogenic injury
Craniectomy
Fish hook retractor

ABSTRACT

Background: Iatrogenic pseudoaneurysms in scalp vessels are an uncommon complication after cranial surgery. This paper reports a case of scalp pseudoaneurysm in the superficial temporal artery (STA) after forceful hook retraction in craniectomy and reviews the relevant literature.

Case description: A 36-year-old man with history of hypertension and depression presented to the emergency department with head injury after using sedation medication. Brain computed tomography (CT) revealed a 2-cm-thick right parietal extradural hematoma (EDH) with parietal skull fracture, a bilateral lower frontotemporal contusional intracerebral hematoma, diffuse subarachnoid hemorrhage, and a right frontotemporoparietal subdural hematoma. To prevent EDH progression, frontotemporal emergency craniectomy to remove the EDH was performed. The next day, a firm, painful mass measuring $3 \times 3.5 \, \text{cm}^2$ was discovered over the right frontal scalp. Sonography revealed pulsatile blood flow with an arterial feeder inside the mass. CT angiography revealed a $1 \times 1.2 \times 0.7 \, \text{cm}^3$ pseudoaneurysm in the right frontal scalp from the frontal branch of the STA. We scheduled a resection of the pseudoaneurysm and combined cranioplasty on the 29th postoperative day. The pseudoaneurysm was resected en bloc. The patient was discharged with clear consciousness and intact muscle power.

Conclusion: The complications of STA pseudoaneurysms caused by scalp hook retractors are rare and not yet well reported. Surgeons must avoid injuring the STA when using a scalp hook retractor.

1. Background

Iatrogenic pseudoaneurysms of scalp vessels are uncommon complications after cranial surgery \cite{1}. Reported mechanisms of iatrogenic scalp pseudoaneurysm include penetrating injury by injection needles \cite{2,3}, the use of pin-type head holders \cite{4,5}, and placement of ventriculoperitoneal shunts \cite{6} or intracranial pressure monitoring devices \cite{7}. The current report describes scalp pseudoaneurysm of the superficial temporal artery (STA) following forceful hook retraction in craniectomy and reviews the relevant literature.

This case report has been reported in line with the SCARE 2020 criteria \cite{8}.

2. Case description

A 36-year-old man with history of hypertension and depression presented to the emergency department with head injury after using sedation medication. He was fully conscious and had intact muscle power in all four limbs. Brain computed tomography (CT) revealed a 2-cm-thick right parietal extradural hematoma (EDH) with parietal skull fracture, a bilateral lower frontotemporal contusional intracerebral hematoma, diffuse subarachnoid hemorrhage, and a right frontotemporoparietal subdural hematoma. To prevent EDH progression, frontotemporal emergency craniectomy to remove the EDH was performed. The next day, a firm, painful mass measuring $3 \times 3.5 \, \text{cm}^2$ was discovered over the right frontal scalp. Sonography revealed pulsatile blood flow with an arterial feeder inside the mass. CT angiography revealed a $1 \times 1.2 \times 0.7 \, \text{cm}^3$ pseudoaneurysm in the right frontal scalp from the frontal branch of the STA. We scheduled a resection of the pseudoaneurysm and combined cranioplasty on the 29th postoperative day. The pseudoaneurysm was resected en bloc. The patient was discharged with clear consciousness and intact muscle power.

**Abbreviations:** STA, superficial temporal artery; CT, computed tomography; EDH, extradural hematoma; ICH, intracerebral hematoma; SDH, subdural hematoma; GWT, Gardner-Wells tongs.

* Corresponding author at: No.901, Zhonghua Rd., Yongkang Dist., Tainan City 710, Taiwan

E-mail address: ygmilloy@gmail.com (Y.-C. Hung).

https://doi.org/10.1016/j.ijscr.2021.106076
Received 30 April 2021; Received in revised form 30 May 2021; Accepted 2 June 2021

Available online 17 June 2021

2210-2612/© 2021 Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license
measuring $3 \times 3.5 \, \text{cm}^2$ was discovered over the right frontal scalp (Fig. 1). The mass was near the site where the scalp hook retractor had been placed during the operation. Sonography revealed pulsatile blood flow inside the mass with an arterial feeder (Fig. 2). CT angiography revealed a $1 \times 1.2 \times 0.7 \, \text{cm}^2$ pseudoaneurysm in the right frontal scalp from the frontal branch of the STA (Fig. 3). The right parietal fracture line did not transverse the STA. Injury to the STA during fish hook retractor placement was suspected. The mass did not change in size in subsequent observation. We scheduled resection of the pseudoaneurysm combined with cranioplasty on the 29th postoperative day. Preoperative sonography revealed reduced blood flow in the pseudoaneurysm. For the craniectomy and pseudoaneurysm resection, the course of the STA was marked using a Doppler vascular detector, and we maintained distance from the STA when placing the fish hook retractor (Fig. 4). A blood clot formation was discovered inside the false lumen, and the feeding artery was ligated using a hemoclip (Fig. 5). The pseudoaneurysm was resected en bloc (Fig. 6). We confirmed that the site of the pseudoaneurysm was where the fish hook retractor had been anchored (Fig. 5). The patient was discharged with clear consciousness and intact muscle power without cosmetic defects. There was no recurrence of the pseudoaneurysm after 6 months follow-up.

3. Discussion

Pseudoaneurysm of the STA is a rare vascular complication following trauma. The etiology of STA pseudoaneurysms includes blunt injury [9], penetrating injury [10], and iatrogenic injury [1]. The present case was pseudoaneurysm of the STA due to iatrogenic injury caused by a fish hook retractor during craniectomy.

A literature review of articles published up to March 31, 2021, was conducted using PubMed and Google Scholar to identify cases of STA pseudoaneurysms with an iatrogenic cause. We excluded duplicate studies, inaccessible articles, and articles not published in English. The published articles were reviewed by all authors to ensure that no potential cases were overlooked.

A total of 13 cases from 12 articles were identified from the literature review. Patient age ranged from 3 weeks to 78 years. Table 1 lists the several iatrogenic etiologies of the 13 cases, 3 of which resulted from craniotomy for intracranial aneurysm [5,11,12]. Two cases were caused by penetrating injury from an injection needle [2,3]. Gardner–Wells tongs (GWT) are an instrument used to facilitate the reduction of cervical spine dislocation, and pin-type head holders are widely used in cranial surgery. GWTs and pin-type head holders can directly apply pressure to the scalp because of their pin-type structure. Two cases, one caused by GWT and one caused by a pin-type head holder [5], were identified. Face lift surgery caused 2 of 13 cases [13], and other iatrogenic etiologies included Mohs surgery for basal cell carcinoma of the lateral forehead [14], bifrontal craniotomy and frontal sinus cranialization for meningioma [15], corrective surgery for craniosynostosis [1], frontal scalp laceration debridement [16], and placement of an...
intrapacranial pressure monitoring device \[7\]. Most cases of STA injury were attributed to direct injury to the vessel by needle penetration, thread penetration, pin-type device penetration, or skin incision.

The STA is a branch of the external carotid artery, and it separates into frontal and parietal branches. The frontal branch of the STA is prone to injury because it lacks protection from muscles when crossing from the temporalis muscle to the frontalis muscle \[16\]. This corresponds with our result that 10 of the 13 cases were caused by frontal branch injury, whereas the remaining 2 cases were caused by parietal branch injury. The two cases of STA injury in the parietal branch were related to pin-type retractor instruments \[4,5\]. This result may be explained by the sites of pin attachment and pressure applied to the scalp.

We have presented a rare complication of craniectomy caused by a scalp hook retractor. A scalp hook retractor is a surgical device with a sharp tip that is widely used in brain surgery for scalp retraction (Fig. 7). It is usually applied at the scalp reflection with pressure applied at its tip by using a rubber band. Penetrating injury can occur if the vessel below the scalp is damaged by the retractor’s sharp tip. When the tip contacts the STA, the pressure exerted by the retractor tip can cause vascular wall damage. We suspected that the pseudoaneurysm was caused by a penetrating injury from the hook retractor, and we confirmed this hypothesis in the second surgery. We took precautions to protect the STA by using a Doppler vascular detector, and no recurrence of the pseudoaneurysm was noted after surgery.

We have presented a rare complication of craniectomy caused by a scalp hook retractor. A scalp hook retractor is a surgical device with a sharp tip that is widely used in brain surgery for scalp retraction (Fig. 7). It is usually applied at the scalp reflection with pressure applied at its tip by using a rubber band. Penetrating injury can occur if the vessel below the scalp is damaged by the retractor’s sharp tip. When the tip contacts the STA, the pressure exerted by the retractor tip can cause vascular wall damage. We suspected that the pseudoaneurysm was caused by a penetrating injury from the hook retractor, and we confirmed this hypothesis in the second surgery. We took precautions to protect the STA by using a Doppler vascular detector, and no recurrence of the pseudoaneurysm was noted after surgery.

Management of STA pseudoaneurysms is diverse and includes complete excision, coil embolization, and manual compression. The optimal treatment modality for STA pseudoaneurysm should be considered case by case. The size of our patient’s pseudoaneurysm was measured each day, and no enlargement or rupture was noted. Therefore, rather than excising the pseudoaneurysm immediately upon discovery, we arranged its resection in combination with cranioplasty.

4. Conclusions

Complications of STA pseudoaneurysms caused by scalp hook retractors are rare and have not yet been reported. A scalp pseudoaneurysm should be suspected when a postoperative mass is noted along the STA after scalp hook retractor use. Preoperative use of a Doppler vascular detector can help surgeons mark the course of the STA and its branches. Surgeons must avoid injury to the STA when using a scalp hook retractor.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Informed consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-chief of this journal on request.

Ethical approval

Not requires.
Table 1
Summary of reported cases of STA pseudoaneurysm.

| Reference | Year | Patient gender | Patient age | Iatrogenic etiology | Possible etiology of pseudoaneurysm formation | Management for pseudoaneurysm | Branch of STA |
|-----------|------|----------------|-------------|--------------------|---------------------------------------------|-------------------------------|---------------|
| Fernandez-Portales et al. [13] | 2016 | Female | 45 | Facial lifting surgery | Antiptosis lifting thread injury | Not mentioned | Frontal branch |
| Corvino et al. [13] | 2016 | Female | 55 | Facial filler silicon oil injection | Injection trauma | Not mentioned | Frontal branch |
| Skaf et al. [3] | 2012 | Female | 60 | Botox injection above the eyebrows and within the left lateral periorbital area | Needle injection trauma | Coil embolization | Frontal branch |
| Dunbar et al. [14] | 2014 | Male | 50 | Mohs surgery for a basal cell carcinoma of the lateral forehead | Vessel injury during cutaneous surgery | Surgical ligation and resection | Frontal branch |
| Wright et al. [15] | 2015 | Male | 78 | Bifrontal craniotomy and frontal sinus craniolization for resection of a right sphenoid wing meningioma and right frontal parasagittal meningioma | N/M | Coil embolization | Frontal branch |

N/M: not mentioned.

Fig. 7. Fish hook retractor used for scalp traction in cranial surgery.

Funding

None.

Guarantor

Hong Xiang Zheng MD.
Yao Lin Lee MD.
Yi-Chieh Hung MD.
Guan-Yu Chen MD.

Research registration number

None.

CRedIT authorship contribution statement

Hong Xiang Zheng, Yao Lin Lee and Yi-Chieh Hung: perform the surgery
Hong Xiang Zheng, Yao Lin Lee and Yi-Chieh Hung: writing the paper
Guan-Yu Chen: collect the references.

Declaration of competing interest

None declared.

References

[1] P. Anania, M. Pacetti, M. Ravegnani, M. Pavanello, G. Piatelli, A. Consales, Iatrogenic pseudoaneurysm of the superficial temporal artery after surgery for scaphocephaly: case report and review of the literature, World Neurosurg. 111 (2018) 60–62.
[2] K. Lin, A. Matarasso, D.R. Edelstein, R.W. Swift, Y. Shnayder, Superficial temporal artery pseudoaneurysm after face lift, Aesthet. Surg. J. 24 (2004) 28–32.
[3] G.S. Skaf, N.T. Domloj, J.A. Salameh, B. Atiyeh, Pseudoaneurysm of the superficial temporal artery: a complication of pin-type head-holder device. Case report, Surg. Neurol. 52 (1999) 400–403.
[4] H.S. Lee, K.W. Jo, S.H. Lee, Whan Eoh, Traumatic pseudoaneurysm of the superficial temporal artery due to Gardner traction, J. Korean Neurosurg. Soc. 48 (2010) 291–293.
[5] I. Fernandez-Portales, J.M. Cabezudo, L. Lorenzana, L. Gomez, L. Porras, J. A. Rodriguez, Traumatic aneurysm of the superficial temporal artery as a complication of pin-type head-holder device. Case report, Surg. Neurol. 52 (1999) 400–403.
[6] M.E. Elgarnal, E.A. Elgarnal, A. Ahmad, A.A. Elsayed, B. Younes, M.K. Aljarak, T. I. Elhadi, Iatrogenic (traumatic) occipital artery pseudoaneurysm – rare complication of ventriculoperitoneal shunt in an infant: case report and review of the literature, Asian J. Neurosurg. 13 (3) (2018) 914–917.
[7] J. Pan, G. Barron, M.E. Greil, R.M. Meyer, C.I. Ene, R.M. Chesnut, Pseudoaneurysm of the superficial temporal artery after intracranial pressure monitoring device placement: case report of a rare complication, Open Neurosurg. (Hagerstown) 19 (2020) 288–291.
[8] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, for the SCARE Group, The SCARE 2020 guideline: updating consensus Surgical Case REport (SCARE) guidelines, Int. J. Surg. 84 (2020) 226-230.

[9] A.J. Cadamy, G.W. McNaughton, R. Helliwell, Traumatic pseudoaneurysms of the superficial temporal artery, Eur J Emerg Med 10 (3) (2003) 236-237.

[10] F. Pourdanesh, M. Salehian, P. Dehghan, N. Dehghani, S. Dehghani, Pseudoaneurysm of the superficial temporal artery following penetrating trauma, J. Craniofac. Surg. 24 (4) (2013) e334-e337.

[11] X. Wang, J.X. Chen, C. You, Iatrogenic false aneurysm caused by surgery of a traumatic intracranial false aneurysm, Neurol. India 59 (2011) 753-755.

[12] S. Teterov, N. McLaughlin, N.A. Martin, Postcraniotomy superficial temporal artery pseudoaneurysm in the setting of triple H therapy: a case report and literature review, Surg. Neurol. Int. 3 (2012) 139.

[13] A. Corvino, O. Catalano, F. Corvino, F. Sandomenico, S.V. Setola, A. Petrillo, Superficial temporal artery pseudoaneurysm: what is the role of ultrasound? J. Ultrasound 19 (2016) 197–201.

[14] S.W. Dunbar, E.A. Hurst, Pseudoaneurysm formation and repair after Mohs micrographic surgery: a report of 3 cases, JAMA Dermatol. 150 (2014) 546-549.

[15] C.H. Wright, J. Wright, A. Badjatiya, S. Manjila, S. Reed, R. Geertman, Ultrasound guided local endovascular coiling of an iatrogenic superficial temporal artery pseudoaneurysm, J. Cerebrovasc. Endovasc. Neurosurg. 17 (2015) 313–317.

[16] F. Xu, D. Sun, L. Zhu, Y. Sun, Pseudoaneurysm of superficial temporal artery after frontal scalp laceration debridement, World Neurosurg. 127 (2019) 117–120.