

# Fundamental Basis of Scalp "Layering" Techniques to Protect Against Wound Infection: A Comparative Study Between Conventional and "In-to-Out" Dissection of the Superficial Temporal Artery Yeongu Chung MD; Sung Ho Lee; Seok Keun Choi MD

#### Introduction

Superficial temporal artery (STA) to middle cerebral artery (MCA) bypass is associated with several surgical problems. Despite the vascular patency and hemodynamic changes after the anastomosis, wound problems can be a major surgical complication.

#### Methods

In a review of 41 surgical cases of STA-MCA bypass for moyamoya disease and cerebral occlusive vascular diseases, we compared the conventional ("Out-to-In") dissection method for STA (n=23) with the "Into-Out" (ITO) dissection method (n=18) and evaluated the surgical results with respect to wound problems.

## Results

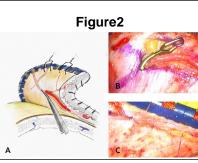
The incidence of skin maceration was significantly higher in the conventional dissection group than the ITO dissection group (34.8% vs. 5.5%; p<0.01). Skin necrosis also showed a higher incidence in the conventional dissection group (39.1%) than the ITO group (22.2%).

## Conclusions

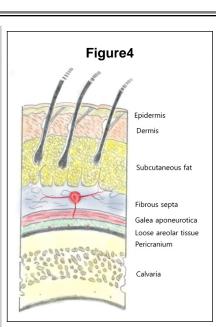
These data suggest that the "layering" technique for surgical wounds protects against contamination from bacteria of the hair follicles. Sealing of galea aponeurotica (1st protective barrier) including fibrous septa, and loose areolar tissues including the periosteal layer (2nd protective barrier) is an important factor to decrease the rate of scalp wound infection.

# Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of postoperative wound complication after bypass surgery, 2) Discuss, different type of donor artery dissection method for micro-vascular anastomosis, 3) Identify an "layering" technique for surgical wound.



Schematic illustration of the in-to-out dissection technique in group B. (B) Factual surgical image of the donor artery surrounded by a thin layer of fibrous septa. (C) After harvesting the parietal branch of the superficial temporal artery, the galea aponeurotica was sealed with simple interrupted sutures with 3-0 absorbable suture material (Vicryl, Ethicon, Somerville, New Jersey, USA).



Schematic illustration of the anatomic sectional layers of scalp tissue. Hair follicles are located in the subcutaneous fatty layer. Almost all arteries that supply blood flow to scalp tissue, including the superficial temporal artery, are located above the galea aponeurotica and run in a parallel direction. There is a thin layer of fibrous septa supporting the galea aponeurotica below the subcutaneous fatty layer. Loose areolar tissue is located between the galea aponeurotica and pericranium.

## References

 Beheiry EE, Abdel-Hamid FA: An anatomical study of the temporal fascia and related temporal pads of fat. Plastic and reconstructive surgery 119:136-144, 2007.
 Broekman ML, van Beijnum J, Peul WC, Regli L: Neurosurgery and shaving: what's the evidence? Journal of neurosurgery 115:670-678, 2011.

3. Dashti SR, Baharvahdat H, Spetzler RF, Sauvageau E, Chang SW, Stiefel MF, Park MS, Bambakidis NC: Operative intracranial infection following craniotomy. Neurosurgical focus 24:E10, 2008. 4. Delgado-Lopez PD, Martin-Velasco V,
Castilla-Diez JM, Galacho-Harriero AM,
Rodriguez-Salazar A: Preservation of bone flap after craniotomy infection. Neurocirugia
(Asturias, Spain) 20:124-131, 2009.
5. Gerhardt LC, Strässle V, Lenz A, Spencer
ND, Derler S: Influence of epidermal hydration on the friction of human skin against textiles.
Journal of the Royal Society Interface 5:1317-1328, 2008.

6. Horgan MA, Kernan JC, Schwartz MS, Kellogg JX, McMenomey SO, Delashaw JB: Shaveless brain surgery: safe, well tolerated, and cost effective. Skull base surgery 9:253-258, 1999.

7. Jinnouchi J, Toyoda K, Inoue T, Fujimoto S, Gotoh S, Yasumori K, Ibayashi S, Iida M, Okada Y: Changes in brain volume 2 years after extracranial-intracranial bypass surgery: A preliminary subanalysis of the Japanese EC-IC trial. Cerebrovasc Dis 22:177-182, 2006. 8. Katsuta T, Inoue T, Arakawa S, Uda K: Cutaneous necrosis after superficial temporal artery-to-middle cerebral artery anastomosis: is it predictable or avoidable? Neurosurgery 49:879-882; discussion 882-874, 2001. 9.Kleintjes WG: Forehead anatomy: arterial variations and venous link of the midline forehead flap. Journal of plastic, reconstructive & aesthetic surgery : JPRAS 60:593-606, 2007. 10. Leclair JM, Winston KR, Sullivan BF, O'Connell JM, Harrington SM, Goldmann DA: Effect of preoperative shampoos with chlorhexidine or iodophor on emergence of resident scalp flora in neurosurgery. Infection control and hospital epidemiology 9:8-12, 1988. 11. Nussbaum ES, Erickson DL: Extracranialintracranial bypass for ischemic cerebrovascular disease refractory to maximal medical therapy. Neurosurgery 46:37-42; discussion 42-33, 2000. 12. Pinar YA, Govsa F: Anatomy of the

 Pinar YA, Govsa F: Anatomy of the superficial temporal artery and its branches: its importance for surgery. Surgical and radiologic anatomy : SRA 28:248-253, 2006.
 Seery GE: Surgical anatomy of the scalp. Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al] 28:581-587, 2002.

14. Smith SF, Simpson JM, Sekhon LH: What progress has been made in surgical management of patients with astrocytoma and oligodendroglioma in Australia over the last two decades? Journal of clinical neuroscience : official journal of the Neurosurgical Society of Australasia 12:915-920; discussion 921, 2005. 15. Takanari K, Araki Y, Okamoto S, Sato H, Yagi S, Toriyama K, Yokoyama K, Murotani K, Matsui S, Wakabayashi T, Kamei Y: Operative wound-related complications after cranial revascularization surgeries. Journal of neurosurgery 123:1145-1150, 2015. 16. Tamura Y, Aoki A, Yamada Y, Nonoguchi N, Yagi R, Tucker A, Kuroiwa T: Dissection of both frontal and parietal branches of the superficial temporal artery for bypass surgery through a single linear skin incision. Acta neurochirurgica 153:1645-1648; discussion 1648, 2011.

17. Toon CD, Lusuku C, Ramamoorthy R, Davidson BR, Gurusamy KS: Early versus delayed dressing removal after primary closure of clean and clean-contaminated surgical wounds. The Cochrane database of systematic reviews:Cd010259, 2015.

18. Ulmer M, Lademann J, Patzelt A, Knorr F, Kramer A, Koburger T, Assadian O, Daeschlein G, Lange-Asschenfeldt B: New strategies for preoperative skin antisepsis. Skin pharmacology and physiology 27:283-292, 2014.

19. Vorstrup S, Brun B, Lassen NA: Evaluation of the cerebral vasodilatory capacity by the acetazolamide test before EC-IC bypass surgery in patients with occlusion of the internal carotid artery. Stroke; a journal of cerebral circulation 17:1291-1298, 1986.

20. Winston KR: Hair and neurosurgery. Neurosurgery 31:320-329, 1992.

21. Yamashita T, Kashiwagi S, Nakano S, Takasago T, Abiko S, Shiroyama Y, Hayashi M, Ito H: The effect of EC-IC bypass surgery on resting cerebral blood flow and cerebrovascular reserve capacity studied with stable XE-CT and acetazolamide test. Neuroradiology 33:217-222, 1991.