

Complications After Cranioplasty are More Common In The Presence of a Preexisting Ventriculoperitoneal Shunt: A Systematic Review and Meta-Analysis

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Introduction

Hydrocephalus can occur following decompressive craniectomy, often requiring placement of a ventriculoperitoneal shunt (VPS) prior to cranioplasty. Recent studies have analyzed risk factors leading to complications following cranioplasty, but these findings vary. Presence of a VPS has been recognized as one such factor. We report a systematic review and meta-analysis comparing complication rates in patients undergoing cranioplasty with the presence or absence of a VPS.

Methods

Following PRISMA guidelines, we performed a systematic search of PubMed as of March 2016. Articles were included if they reported complications related to cranioplasty after decompressive craniectomy and recorded the absence or presence of a VPS at time of cranioplasty with at least 20 patients. Primary outcomes were infection and resorption. For articles reporting events, odds ratios (OR) and confidence intervals (CI) were calculated. For articles only reporting OR and CI, these were used to calculate standard error. Data was pooled using the Mantel-Haenszel method (fixed-effects, inverse variance weight).

Results

Six of 93 studies met inclusion criteria (total 1417 patients, 164 shunts). The presence of a VPS was associated with increased rate of resorption often requiring reoperation (5 studies, 1304 patients, OR 6.07, CI 3.97-9.30, $p < 0.001$) and with increased rate of infection (3 studies, 467 patients, OR 4.87, CI 2.35-10.10, $p < 0.001$).

Infections

Cite	Totals		Infection		Odds Ratio			
	VPS	None	VPS	None	OR	SE	Low	High
2013 Yang	21	109	5	7	4.55	0.64	1.29	16.10
2014 Piedra	18	157			1.94	0.67	0.52	7.18
2015 Tsang	21	141	6	7	7.66	0.62	2.27	25.78

60	407
467	

OR	4.87
SE	0.37
95% lower limit	2.35
95% upper limit	10.10
Z-value	4.26
p-value (2 tail)	< 0.001

Resorption

Cite	Totals		Resorption		Odds Ratio			
	VPS	None	VPS	None	OR	SE	Low	High
2013 Schuss	61	254	4	6	2.90	0.66	0.79	10.62
2014 Piedra	18	157			0.68	0.77	0.15	3.01
2015 Mracek	22	127			35.56	0.65	9.96	126.96
2015 Schwarz	21	482			1.73	0.27	1.02	2.92
2015 Tsang	21	141	3	2	11.58	0.95	1.81	74.06

143	1161
1304	

OR	6.07
SE	0.22
95% lower limit	3.97
95% upper limit	9.30
Z-value	8.31
p-value (2 tail)	< 0.001

Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) Identify the presence of a ventriculoperitoneal shunt (VPS) at time of delayed cranioplasty as associated with increased incidence of resorption and infections.
- 2) In susceptible patients, discuss the appropriateness of using non-resorptive synthetic implants, extended perioperative antibiotics, and additional infection precautions.

References

- [1]Schuss P, Vatter H, Oszvald Á, Marquardt G, Imöhl L, Seifert V, et al. Bone flap resorption: Risk factors for the development of a long-term complication following cranioplasty after decompressive craniectomy. *J Neurotrauma* 2012;95:120912140809000. doi:10.1089/neu.2012.2542.
- [2]Piedra M, Nemecek A, Ragel B. Timing of cranioplasty after decompressive craniectomy for trauma. *Surg Neurol Int* 2014;5:25. doi:10.4103/2152-7806.127762.
- [3]Mracek J, Hommerova J, Mork J, Richtr P, Priban V. Complications of cranioplasty using a bone flap sterilised by autoclaving following decompressive craniectomy. *Acta Neurochir (Wien)* 2015;157:501-6. doi:10.1007/s00701-014-2333-0.
- [4]Schwarz F, Dünisch P, Walter J, Sakr Y, Kalff R, Ewald C. Cranioplasty after decompressive craniectomy: is there a rationale for an initial artificial bone-substitute implant? A single-center experience after 631 procedures. *J Neurosurg* 2016;124:710-5. doi:10.3171/2015.4.JNS159.
- [5]Tsang AC-O, Hui VK-H, Lui W-M, Leung GK-K. Complications of post-craniectomy cranioplasty: Risk factor analysis and implications for treatment planning. *J Clin Neurosci* 2015;22:834-7. doi:10.1016/j.jocn.2014.11.021.
- [6]Yang S, Park H, Cho S. The Current Analysis of the Risk Factors for Bone Graft Infection after Cranioplasty. *Korean J Neurotrauma* 2013;9:57-63.