The Hair-sparing Approach Versus the Traditional Hair Clipping for Cerebral Spinal Fluid (CSF) Shunting Procedures: A Retrospective Comparative Study

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INTRODUCTION

Hair removal, through shaving or clipping, at the incision site for cerebral spinal fluid (CSF) shunting has been a common practice among neurosurgeons. This is due to the perception that hair removal would enhance visualization of the scalp, allow for an unimpeded skin incision and closure, and reduce the risk of infection[1].

Hair removal can act as a source of insecurity regarding appearance, particularly among children and adolescents. Therefore, the hair-sparing approach is often favored by patients and families.

The objective of this study is to conduct a comparative analysis of the infection rates among a cohort of pediatric patients who underwent CSF shunting via a zero-hair removal (ZHR) versus hair removal (HR) technique.

METHODS

A retrospective, single-institution comparative study was conducted at the Montreal Children's Hospital (MCH) of the McGill University Health Centre (MUHC), examining 435 shunt procedures performed on 226 unique patients between August 2014 and April 2021. Each patient was monitored for a minimum of 18 months following their shunting procedure. Data extraction was carried out by accessing the electronic medical records of each patient. The primary outcome was the assessment of shunt infection, while shunt malfunction was evaluated as the secondary outcome.

For the analysis, two different approaches were employed. Firstly, a chi-square test of independence was used to examine the potential association between the surgical protocols and the incidence of primary and secondary outcomes. Additionally, a survival analysis utilizing the Cox proportional-hazard model was carried out to compare time to infection between the two surgical groups. Several factors, including age at surgery, gender, shunt indication, and prior shunt procedures, were examined to assess their influence on the hazard of the primary outcome.

Shunt Indication
- Aqueduct Stenosis
- Hemorrhage
- Trauma
- Infection
- Tumor

Shunt Complications
- Infection
- Obstruction
- Disconnection

Infection Etiologies
- Shunt colonization
- Retrograde infection
- Poor skin healing

Infection Risk Factors
- Previous shunt infections
- Frequent shunt revisions (more than 3)
- Interventricular hemorrhage
- Meningitis

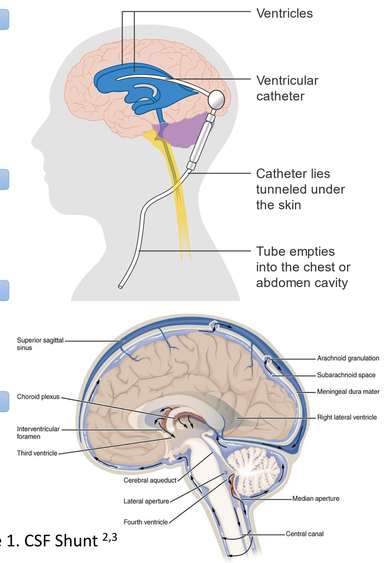

Figure 1. CSF Shunt [2,3]

	Hair Removal (HR)			Zero Hair Removal (ZHR)		
	n		%	n		%
Number of Unique Patient-Treatments	166		66.14%	85		33.86%
Sex (F/M)	68/98		40.97%/59.03%	32/53		37.65%/62.35%
Age at Surgery Range	0.01 years – 17.99 years			0.01 years – 17.99 years		
Age at Surgery (Mean, SD)	4.8 years, 5.29 years			5.78 years, 5.69 years		
Age Category at Surgery	Neonate (<1 month)	23	8.21%	Neonate (<1 month)	12	7.74%
	Infant (1 month – 1 year)	77	27.50%	Infant (1 month – 1 year)	49	31.61%
	Child (1 year – 18 years)	180	64.29%	Child (1 year – 18 years)	94	60.65%
Shunt Procedure Category	Ventriculo-Peritoneal	227	81.07%	Ventriculo-Peritoneal	118	76.13%
	Ventriculo-Atrial	8	2.86%	Ventriculo-Atrial	9	5.81%
	Ventriculo-Subgaleal	21	7.50%	Ventriculo-Subgaleal	15	9.68%
	Other	24	8.57%	Other	13	8.39%
Shunt Insertion/Revision	Insertion	121	43.21%	Insertion	73	47.10%
	Revision	159	56.79%	Revision	82	52.90%
Shunt Indication & Etiology	Hydrocephalus of Prematurity	108	38.57%	Hydrocephalus of Prematurity	68	43.87%
	Tumor	47	16.78%	Tumor	25	16.13%
	Aqueduct Stenosis	12	4.28%	Aqueduct Stenosis	5	3.23%
	Other	113	40.36%	Other	57	36.77%
Number of Surgeries on Patients with No Prior Shunt Procedures	79		28.21%	37		23.87%
Shunt Infection	10		3.57%	2		1.29%
Shunt Malfunction	40		14.29%	20		12.90%

Table 1. Descriptive Study Data

RESULTS

Out of the 435 total procedures, 155 were performed by one surgeon using the ZHR approach, while 280 were performed by three other surgeons using the HR technique. Table 2 presents the results of the chi-square test, focusing on the surgical approach. The obtained p-value of 0.340 suggests that there is insufficient evidence to conclude that there are significant differences among the outcome percentage profiles at the 0.05 level of significance. The risk of shunt infection was 1.29 percent in the ZHR group and 3.57 percent in the HR group, with an absolute risk difference of 2.28% (95% CI -0.5%, 5.11%, p=0.165).

The outcome of the log-rank test revealed a p-value of 0.18, indicating that there is no significant difference between the survival curves of the two groups. The hazard ratio for shunt infections was 0.37 (95% CI 0.08, 1.67, p=0.19) between the ZHR and HR groups (Figure 3). The estimated hazard ratio did not significantly change when accounting for confounders.

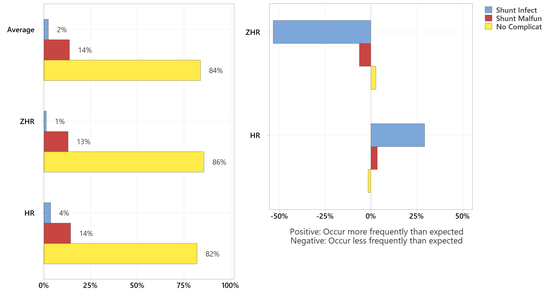

Figure 2. Percentage Profiles Chart and % Difference between Observed and Expected Counts

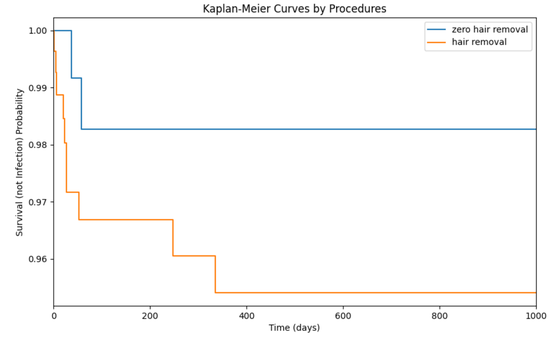

Figure 3. Kaplan-Meier Survivor Curves Comparing Hazard of Infection

Observed and Expected Counts

	ZHR		HR	
	Obs	Exp	Obs	Exp
Shunt Infect	2	4.3	10	7.7
Shunt Malfun	20	21	40	39
No Complicat	132	128	229	233
Total	154		279	

Expected counts should be at least 2 to ensure the validity of the p-value for the test.

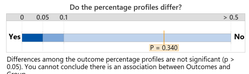

Table 2. Chi-Square Test for Association: Outcomes by Procedures

CONCLUSION

The statistical analysis conducted indicated that there was no statistically significant difference in the infection rate between the two cohorts. Therefore, it can be inferred that the zero-hair removal technique is a safe alternative to the hair removal approach in the context of CSF shunt procedures.

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