

## National CPT and ICD Surgical Outcomes After Pediatric Front-orbital Advancement Surgery

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**BACKGROUND:** Frontoorbital advancements (FOA) for craniosynostosis is the gold-standard of treatment to prevent future neurological deficits from restricted calvaria growth. Due to many centers operating in isolation, FOA complications and reoperation rates have limited studies completed on a national level. This retrospective analysis aims to use a multicenter billing database with more recent data to identify the current demographics of patients undergoing FOA, evaluate the short-term and long-term reoperation rates, and identify intra- and post-operative complication rates.

**METHODS:** Consecutive patients needing forehead advancement between 2010 and 2020 were identified from a Pearldiver™, a national deidentified aggregate database. Patients were eligible for inclusion if they underwent operative treatment of a FOA and were billed with CPT-21175 between the ages 0 and 5 years old. Intra and post-operative complications were queried using CPT, ICD-9, and ICD-10 codes. Post-operative complications were identified 0, 30, 90, 180, and 365 days after surgery and identified based on need for reoperation.

**RESULTS:** A total of 1,905 patients between 0 to 5 years old were identified to have received FOA based on CPT-21175. Hemorrhage and hematoma of the nervous system was the most common intraoperative complication (0.32%). Hardware complications (2.37%) and wound dehiscence (2.37%) were the most common postoperative complications one year after surgery based on ICD-9 and ICD-10 codes identified. Removal of the implant after one year (3.37%) was the most common cause of a reoperation with an overall return to surgery rate of 7.15%.

**CONCLUSION:** FOA surgical repair was found to be a safe procedure with low complication rates and reoperation needs. Surgeons must continue to stay vigilant when treating pediatric craniosynostosis patients to maintain low complication rates and better inform future families of unintentional FOA procedure outcomes.

Category	ICD-9	ICD-10	Description	0 to 5	6 to 16
Diagnosis	997.01, 997.09	G97.3, G97.8	Intraoperative hemorrhage & hematoma of the nervous system	6 (0.32%)	2 (1.65%)
	-	M96.81	Intraoperative hemorrhage & hematoma of musculoskeletal system	1 (0.05%)	0 (0%)
	997.39	J95.88	Intraoperative hemorrhage & hematoma of respiratory	4 (0.21%)	0 (0%)
	998.89	L76.8	Intraoperative hemorrhage & hematoma of skin and subcutaneous tissue	0 (0%)	0 (0%)
	-	I97.81	Intraoperative cerebrovasc infarction	0 (0%)	0 (0%)
	-	I97.79	Intraoperative cardiac function disturbance	1 (0.05%)	0 (0%)
	-	I97.71	Intraoperative Cardiac Arrest	2 (0.10%)	0 (0%)
Procedure	P-01.39	009030Z	Drainage of Brain with Drainage Device	3 (0.16%)	1 (0.83%)
	P-01.31	00910ZZ	Drainage of Cerebral Meninges	0 (0%)	0 (0%)
	P-01.12	00920ZX	Drainage of Dura Mater	0 (0%)	0 (0%)
	-	009330Z	Drainage of Intracranial Epidural Space with Drainage Device	3 (0.16%)	0 (0%)
	P-02.22	009440Z	Drainage of Intracranial Subdural Space with Drainage Device	1 (0.05%)	0 (0%)
	P-93.39	F08D5FZ	Wound Management Treatment of Integumentary System - Head and Neck	0 (0%)	0 (0%)
	P-86.74	0JX00ZC	Transfer Scalp Subcutaneous Tissue and Fascia with Skin, Subcutaneous Tissue and Fascia, Open Approach	18 (0.95%)	5 (4.13%)

**Table 1.** ICD-9 and ICD-10 codes used for data collection of intraoperative complications in both age groups

Description	0d	30d	90d	180d	365d
Cerebrospinal fluid leak	7 (0.36%)	7 (0.36%)	12 (0.63%)	12 (0.63%)	13 (0.69%)
Death	0 (0%)	1 (0.05%)	1 (0.05%)	1 (0.05%)	1 (0.05%)
Hardware complications	5 (0.26%)	7 (0.36%)	17 (0.89%)	34 (1.79%)	45 (2.37%)
Hemorrhage	9 (0.47%)	30 (1.58%)	31 (1.68%)	37 (1.95%)	42 (2.21%)
Seizure	0 (0%)	3 (0.16%)	3 (0.16%)	3 (0.16%)	3 (0.16%)
Surgical site infection	4 (0.21%)	38 (2.00%)	56 (2.95%)	69 (3.63%)	80 (4.21%)
wound dehiscence	2 (0.10%)	16 (0.84%)	25 (1.32%)	35 (1.84%)	45 (2.37%)

**Table 2.** Complications based on ICD-9 and ICD-10 codes for the younger group aged 0-5 years old.

CPT	Description	0d	30d	90d	180d	365d
10120	Incision and removal of foreign body, subcutaneous tissue simple	0 (0%)	2 (0.10%)	2 (0.10%)	5 (0.26%)	5 (0.26%)
10121	Incision and removal of foreign body, complicated.	0 (0%)	1 (0.05%)	2 (0.10%)	3 (0.16%)	3 (0.16%)
10140	Incision and drainage of hematoma, seroma or fluid collection	0 (0%)	5 (0.26%)	9 (0.47%)	10 (0.53%)	13 (0.68%)
10180	Incision and drainage, complex, post-operative wound infection	0 (0%)	6 (0.32%)	10 (0.53%)	13 (0.68%)	18 (0.95%)
13160	Secondary closure of surgical wound or dehiscence, extensive or complicated	0 (0%)	2 (0.10%)	9 (0.47%)	13 (0.68%)	15 (0.79%)
15004, 15005	Wound debridement and wound preparation	0 (0%)	2 (0.10%)	3 (0.16%)	3 (0.16%)	3 (0.16%)
14020, 14301, 14302	Adjacent tissue transfer scalp and any area	22 (1.16%)	4 (0.21%)	6 (0.32%)	8 (0.42%)	11 (0.58%)
61501	Craniectomy with excision of bone for osteomyelitis	0 (0%)	0 (0%)	3 (0.16%)	3 (0.16%)	3 (0.16%)
61315	Craniectomy or craniotomy for evacuation of hematoma	1 (0.05%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
61316	Incision and subcutaneous placement of cranial bone graft	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
61320, 61321	Craniectomy or craniotomy, drainage of intra-cranial abscess	0 (0%)	5 (0.26%)	6 (0.32%)	6 (0.32%)	6 (0.32%)
61322	Craniectomy or craniotomy, decompressive with or without duraplasty	6 (0.32%)	0 (0%)	0 (0%)	0 (0%)	1 (0.05%)
61105	Twist drill hole for subdural or ventricular puncture	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
61107	Twist drill holes for subdural, intracerebral, or ventricular puncture; for implanting a ventricular catheter (EVD)	1 (0.05%)	1 (0.05%)	2 (0.10%)	2 (0.10%)	3 (0.16%)
61108	Twist drill hole for evacuation and/or drainage of subdural hematoma	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
62190	Creation of shunt, subarachnoid/subdural-atrial, jugular, auricular	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
62192	Creation of shunt, subarachnoid/subdural - peritoneal, pleural, other terminus	0 (0%)	1 (0.05%)	1 (0.05%)	1 (0.05%)	1 (0.05%)
62220	Creation of shunt; ventriculo-atrial, jugular, auricular	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
62223	Creation of shunt; ventriculo-peritoneal, pleural, other terminal	0 (0%)	5 (0.26%)	5 (0.26%)	10 (0%)	15 (0.26%)
62100	Craniotomy for repair of dural/CSF fluid leak, including surgery for rhinorrhea or otorrhea	2 (0.10%)	4 (0.21%)	6 (0.32%)	6 (0.32%)	6 (0.32%)
11042, 11045	debridement, subcutaneous tissue, first 20 square centimeters or less AND each additional 20 square centimeters	0 (0%)	1 (0.05%)	4 (0.21%)	6 (0.32%)	10 (0.53%)
11043, 11046	debridement, muscle/fascia	0 (0%)	2 (0.10%)	2 (0.10%)	4 (0.21%)	5 (0.26%)
11044, 11047	debridement, bone	0 (0%)	4 (0.21%)	7 (0.37%)	10 (0.53%)	14 (0.74%)
20670	removal of implant, superficial (buried wire, pin, or rod)	0 (0%)	1 (0.05%)	4 (0.21%)	5 (0.26%)	7 (0.37%)
20680	removal of implant, deep	13 (0.68%)	3 (0.16%)	24 (1.26%)	47 (2.47%)	64 (3.37%)

**Table 3.** Complications requiring reoperation based on CPT codes in the younger group aged 0 to 5 years old