

Social Burden of Ventriculo-Peritoneal Shunt and Shunt Revision in Congenital Hydrocephalus: Nationwide Inpatient Sample Database Study (2002-2011)

Tanmoy Kumar Maiti Mch; subhas konar; Shyamal C Bir MD PhD; Anil Nanda MD, FACS [LSU Health Sciences Center,Shreveport]



Introduction

The prevalence of congenital hydrocephalus has been estimated to range from 0.5 to 0.8 per 1000 live births. Hydrocephalus represents a high health care burden in the US with ventriculoperitoneal shunting and its associate hospital charges totaling almost \$2 billion annually in children 0-18 years. This study aims to use a large administrative database to describe the current practice, correlates and effectiveness of primary ventriculoperitoneal shunt and shunt revision (replacement, abdomen end revision) and removal in patients with congenital hydrocephalus age 0 -18 years.

Methods

The National (Nationwide) Inpatient Sample database was queried for all patients with the diagnosis of congenital hydrocephalus (International Classification of Diseases, Ninth Revision, code 742.3) from 2002 to 2011. These data were stratified by operative intervention: primary ventriculoperitoneal shunt (02.34), replacement (02.42) abdominal end revision (54.95) and removal of shunt (02.43) with demographic and hospitalization charge data generated for each. The outcome and charge was compared according to case load of hospital.

Results

We found 22176 patients of congenital hydrocephalus of age 0-18 years. 27.39% patients underwent ventriculo-peritoneal shunt for the first time and 84.9% of them were <1 year. Routine discharge was better for patients with shunt replacement in compare to primary ventriculo-peritoneal shunt. The charges of primary ventriculo-peritoneal shunt has increased by 103% whereas the charge of shunt replacement has increased by 51.15% from 2002 to 2011 (p<0.05).

Demographics								
		Primary v-p shunt (n=7152)	Shunt ventric end revision (n=12118)	Shunt abdomen end revision (n=1306)	Shunt removal (n=1600)			
AGE	<1 YEAR	6075 (84.9%)	2669 (22.0%)	188 (11.7%)	546 (41.8%)			
	>= 1 YEAR	1077 (15.1%)	9449 (78.0%)	1412 (88.3%)	760 (58.2%)			
SEX	MALE	4018 (56.2%)	6897 (56.9%)	853 (53.3%)	651 (49.9%)			
	FEMALE	3129 (43.7%)	5196 (42.9%)	746 (46.7%)	655 (50.1%)			
RACE	WHITE	2959 (41.4%)	5321 (43.9%)	765 (47.9%)	462 (35.4%)			
	BLACK	943 (13.2%)	1671 (13.8%)	235 (14.7%)	193 (14.8%)			
	HISPANIC	1094 (15.3%)	1674 (13.8%)	228 (14.3%)	186 (14.2%)			
	Asian or Pacific Islander	156 (2.2%)	239 (2%)	28 (1.7%)	29 (2.3%)			
	Native American	33 (0.5%)	45 (0.4%)	11 (.7%)	0			
	OTHER	392 (5.5%)	347 (2.9%)	77 (4.8%)	66 (5.0%)			
INSURANCE	Medicare	10 (0.1%)	30 (0.2%)	0				
	Medicaid	3949 (55.2%)	5663 (47%)	786 (49.1%)	673 (51.5%)			
	Private insurance	2727 (38.1%)	5697 (47%)	773 (48.3%)	574 (44.0%)			
	Self-pay	161 (2.2%)	179 (1.5%)	14 (.9%)	19 (1.4%)			
	No charge	18 (0.2%)	13 (0.1%)	0				
	Other	269 (3.8%)	527 (4.3%)	27(1.7%)	40 (3.1%)			

Domographics

Hospital characteristics

Hospital characteristics

		Primary v-p shunt (n=7152)	Shunt ventricend revision (n=12118)	Shunt abdomen end revision (n=1306)	Shunt removal (n=1600)
Hospital region	Northeast	1287 (18.0%)	2558 (21.1%)	490 (30.6%)	342 (26.2%
	Midwest	1373 (19.2%)	2843 (23.5%)	333 (20.8%)	309 (23.6%
	South	3167 (44.3%)	4068 (33.6%)	536 (33.5%)	357 (27.4%
	West	1325 (18.5%)	2649 (21.9%)	241 (15.1%)	298 (22.8%
Teaching status of hospital	Nonteaching	737 (10.3%)	751 (6.2%)	119 (7.4%)	122 (9.4%
	Teaching	6369 (89.1%)	11282 (93.1%)	1459 (91.2%)	1179 (90.3%
LOCATION	Rural	119 (1.7%)	214 (1.8%)	42 (2.6%)	32 (2.5%
	Urban	6987 (97.7%)	11819 (97.5%)	1536 (96.0%)	1269 (97.2%
BEDSIZE	SMALL	757 (10.6%)	2012 (16.6%)	159 (9.9%)	204 (15.6%
	MEDIUM	1415 (19.8%)	2410 (19.9%)	272 (17.0%)	316 (24.2%
	LARGE	4935 (69.0%)	7612 (62.8%)	1147 (71.7%)	781 (59.8%



Hospital charges of primary shunt and shunt revision: adjusted to 2014



Discharge patterns

Pattern of disposition of patients

		Primary v-p shunt (n=7152)	Shunt ventric end revision (n=12118)	Shunt abdomen end revision (n=1306)	Shunt removal (n=1600)
Disposition of patient	Routine	5779 (80.8%)	11332 (93.5%)	1498 (93.6%)	1063 (81.4%)
	Transfer to Short- term Hospital	341 (4.8%)	101 (0.8%)	20 (1.3%)	35 (2.7%)
	Transfer Other: Includes Skilled Nursing Facility, Intermediate Care Facility, Another Type of Facility	127 (1.8%)	173 (1.4%)	16 (1.0%)	33 (2.5%)
	Home Health Care	781 (10.9%)	426 (3.5%)	60 (3.8%)	149 (11.4%)
	Against Medical Advice	<10 (.1%)	<10[.0%]	0	
	Died	118 (1.7%)	76 (0.6%)	<10 (0.3%)	25 (1.9%)

Comparison of complications



Conclusions

Our result shows the increasing burden of hospital charges for congenital hydrocephalus. Neurologic, wound and cardiac complications were more when shunt revision/ replacement was performed in age<1 year sub-group. cardiac complications were more in patients with age >=1 who underwent priimary V-P shunt. However unfavorable discharge and in-hospital mortality was more in patients who underwent primary V-P shunt rather than shunt revision/ replacement surgery.

Learning Objectives

Socio-economic burden of primary v-p shunt and shunt revision in congenital hydrocephalus

References

1.Notarianni C, Vannemreddy P, Caldito G, Bollam P, Wylen E, Willis B, et al: Congenital hydrocephalus and ventriculoperitoneal shunts: influence of etiology and programmable shunts on revisions. J Neurosurg Pediatr 4:547-552, 2009

2.Patwardhan RV, Nanda A: Implanted ventricular shunts in the United States: the billion-dollar-a-year cost of hydrocephalus treatment. Neurosurgery 56:139-144; discussion 144-135, 2005