



Vaccination as Primary Prevention? The Effect of Anti-Pneumococcal Vaccination on the Outcome of Patients Suffering Traumatic Skull Base Fractures

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Introduction

As many as 360,000 people suffer yearly from skull base fractures (SBF). These may be associated with a dural tear, hemosinus, otorrhea or rhinorrhea. The most common causative agent of post-traumatic meningitis is Streptococcus Pneumonia (Pneumococcus). PNEUMOVAX 23 is a potent vaccine against Pneumococcus, but head trauma involving any skull fractures are not defined indications for its use. Our aim was to identify the effect of PNEUMOVAX on the natural course and incidence of infections and infectious prognosis following SBF.

Setting

A retrospective review of patients suffering a traumatic SBF who were admitted to the Department of Neurosurgery at a single tertiary hospital referred from the entire north of Israel during 2002-2009.

Table 1 – Epidemiological Data				
		Not Vaccinated n=503	Vaccinated n=99	Significance
Males (%)		374 (74.4%)	85 (85.9%)	P=0.014
Duration of admission (Days)		5.01±4.27	5.16±4.92	P=0.76
Age		25.77±26.15 (15)	33.79±22.31 (32)	P<0.0001
Path of admission	Trauma room	28 (5.6%)	7 (7.1%)	P=0.69
	Emergency room	197 (39.2%)	35 (35.4%)	
	Primary hospital	277 (55.2%)	57 (57.6%)	

Participants

602 patients included in the study.

Interventions

99 patients received the PNEUMOVAX in the first few days of hospitalization, while 503 patients did not.

Table 2 – Chronic diseases on admission			
	Not Vaccinated n=503	Vaccinated n=99	Significance
Hypertension	36 (7.8%)	11 (12.1%)	P=0.21
Ischemic heart disease (CCS*)	2(0.4%)	-	P=1.00
Diabetes mellitus	10 (2.1%)	5 (5.2%)	P=1.00
Obesity	10 (2.1%)	7 (7.3%)	P=0.014
Immunocompetent	477 (100%)	98 (100%)	-

* CANADIAN CARDIOVASCULAR SOCIETY

Primary and secondary outcome measures

Demographic data, presenting symptoms, chronic illnesses and radiologic features were logged. Treatment regimens were logged as well, including the use of PNEUMOVAX vaccine. Outcome parameters including infectious complications and functional state were logged at different set time points after admission.

Table 3 – Admission Symptoms and Signs				
Symptoms on Admission				
		Not Vaccinated n=503	Vaccinated n=99	Significance
Headache	None	250 (52.6%)	30 (32.3%)	P=0.0003
	Focal Diffuse	5 (1%) 220 (46.3%)	- 63 (67.7%)	
Confusion		66 (13.6%)	22 (23.4%)	P=0.027
Vomiting / Nausea		192 (39.3%)	33 (34.4%)	P=0.42
Signs on Admission				
Early Cranial nerve palsy		13 (2.6%)	4 (4.1%)	P=0.50
Late Cranial nerve palsy		11 (2.2%)	1 (1%)	P=0.70
Early Rhinorrhea		8 (1.6%)	1 (1%)	P=1.00
Late Rhinorrhea		3 (0.6%)	1 (1%)	P=1.00
Early Otorrhea		128 (25.5%)	30 (30.3%)	P=0.32
Late Otorrhea		4 (0.8%)	2 (2%)	P=0.26
Admission GCS*		13.07±4.59	13.27±4.38	P=0.68
Admission KPS**		66.66±28.42	66.55±27.55	P=0.97
Admission Body Temp.	Normal	488 (98.6%)	96 (98.0%)	P=0.65
	>38.3°	6 (1.2%)	1 (1.0%)	
	<36°	1 (0.2%)	1 (1.0%)	
Admission WBC***	Normal (4.8~10.8)	83 (25.2%)	25 (30.9%)	P=0.30
	Moderate (11~15.9)	149 (45.2%)	29 (35.8%)	
	High (>16)	98 (29.7%)	27 (33.3%)	
Admission PMN+	Normal (40~74%)	112 (36%)	23 (31.5%)	P=0.69
	>75%	188 (60.5%)	48 (65.8%)	
	<40%	11 (3.5%)	2 (2.7%)	
Hemoglobin g/dl	Normal (11.5-14.8)	224 (67.7%)	47 (58%)	P<0.0001
	>75%	67 (20.2%)	7 (8.6%)	
	Anemia Erythrocytosis	40 (12.1%)	27 (33.3%)	

*GCS – Glasgow coma score. **KPS – Karnofsky performance scale, ***WBC – white blood count, +PMN – polymorphonuclear count

Table 4 – Radiological Features				
		Not Vaccinated n=503	Vaccinated n=99	Significance
Number of fractures	1	247 (60.8%)	48 (63.9%)	P=0.009
	2	102 (25.1%)	22 (24.7%)	
	3	30 (7.4%)	11 (12.4%)	
	>4	27 (6.6%)	8 (8.9%)	
Length of Skull base fracture (cm)	Anterior fossa	7.85±6.79 (7)	9.38±6.39 (8)	P=0.009
	Middle Fossa (Not petrous)	133 (26.4%)	29 (29.3%)	
	Anterior petrous	67 (13.3%)	12 (12.1%)	
	Posterior petrous	70 (13.9%)	20 (20.2%)	
	Posterior fossa (not mastoid)	14 (2.8%)	4 (4.1%)	
	Mastoid	114 (22.7%)	22 (2.2%)	
	Frontal	154 (30.6%)	39 (39.4%)	
	Ethmoidal	73 (14.5%)	20 (20.2%)	
	Sphenoidal	75 (14.9%)	20 (20.2%)	
	Mastoid	24 (4.8%)	11 (11.1%)	
Sinus involvement in fracture line	Maxillary	3 (0.6%)	-	P=0.031
	Hemosinus	44 (8.7%)	11 (11.1%)	
	Pneumocephalus	257 (63.3%)	58 (65.2%)	
	None	231 (56.9%)	44 (50%)	
	Minimal Substantial	144 (35.5%)	35 (39.8%)	
Sinus vein thrombosis		9 (10.2%)	9 (10.2%)	P=0.14
		328 (81%)	65 (73.9%)	

Results

The group receiving the vaccine had a significantly older mean age, higher incidence of obesity, higher rate of headache or confusion on presentation, and a significantly higher incidence of additional cranial injuries. All these factors, known to worsen the outcome of SBF patients did not manifest in the vaccinated group. There was no statistically significant differences between the groups in the outcome parameters measured (fever, meningitis, mortality or length of hospitalization).

Table 5 – Outcome Parameters			
	Not Vaccinated n=503	Vaccinated n=99	Significance
Fever in 48 hours	7 (1.4%)	3 (3.0%)	P=0.22
Fever during 1 st week	14 (2.8%)	5(5.1%)	P=0.22
Fever during 1 st month	4 (0.8%)	2 (2.0%)	P=0.26
Meningitis in 48 hours	3 (0.6%)	-	P=1.00
Meningitis during 1 st week	4 (0.8%)	-	P=1.00
Meningitis during 1 st month	2 (0.4%)	1 (1.0%)	P=0.42
Indication for Antibiotics during 1 st week	18 (3.6%)	7 (7.1%)	P=0.16
Indication for Antibiotics during 1 st month	8 (1.6%)	2 (2.0%)	P=0.67
Mortality in 48 hours	1 (0.2%)	-	P=1.00
Mortality during 1 st week	2 (0.4%)	1 (1.0%)	P=0.42
Mortality during 1 st month	1 (0.2%)	1 (1.0%)	P=0.30

Table 6 – Multivariate model for the prediction of Fever, or indications for Antibiotics. Significant parameters					
Fever					
Parameter	Upper	Lower	B	SIGNIFICANCE	Odds Ratio
Hypertension	17.288	1.757	1.707	0.003	5.5
Maxillary sinus involvement in fracture line	16.661	1.410	1.578	0.012	4.8
Any indication for Antibiotics					
Age	1.046	1.002	0.024	0.032	1.024
Ethmoid sinus involvement in the fracture line	11.374	1.577	1.444	0.004	4.2

Table 7 – Incidence of complications after Skull base fractures. Comparison to findings reported on literature		
Parameter	Literature review	Rambam's Database
Meningitis incidence after skull base fractures.	9.2-23.5%	1.6% (10/602)
Meningitis incidence after clinically evident CSF leakage	7-50%	2.2% (4/177)
The incidence of Rhinorrhea among meningitis patients with skull base fractures.	48-58%	0% (0/10)
The incidence of a <u>lack</u> of clinically evident CSF leakage among meningitis patients with skull base fractures.	15-16%	60% (6/10)

Conclusions

We suggest that patients with a more severe status upon admission may benefit from a prophylactic treatment with the PNEUMOVAX vaccine.

Fractures of the cribriform plate (A) and fracture throu

