

THE TREATMENT OF PURULENT MENINGITIS WITH ADRENAL CORTICO-STEROIDS

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Purulent Meningitis had been a common cause of death in infants and children during the pre-antibiotic era. With the introduction of antibiotics, the mortality rate had dropped. At the same time neurological complications and sequelae, as a result of meningitis, had been noticed more frequently. The neurological complications are due to inflammation and tissue damage which occurred before treatment and also persist even after the infection has been relieved. Since 1958, Adrenal Cortico-steroid was used as an adjuvant in the treatment of purulent meningitis in the Unit. The Adrenal Cortico-steroid was used in an attempt to reduce the tissue damage by relieving pressure caused by oedema and inflammation.

This paper is a review on the results of treatment of purulent meningitis during the last 3 years. Its aim is to determine whether there is any difference in mortality and neurological se-

quelae between the group treated with cortico-steroids and the group without cortico-steroids. The cases are divided into 3 groups, the steroid, non steroid and delayed steroid groups. The latter group comprised of cases who on admission were not given any cortisone but for various reasons cortico-steroids were added after the 5th day of admission. The common reasons were the discovery of a block somewhere along the route of the cerebral spinal fluid as revealed by markedly raised protein level in the cerebral spinal fluid or the observation that the condition of the patient was deteriorating as shown by deepening of coma or the discovery of neurological complications. In the steroid group, adrenal cortico-steroids were given 12-24 hours after admission. The 12-24 hour lapse was to ensure an adequate level of antibiotic in the body before the commencement of steroid. Intravenous or intramuscular hydrocortisone ranging from 100 mgm - 250 mgm daily

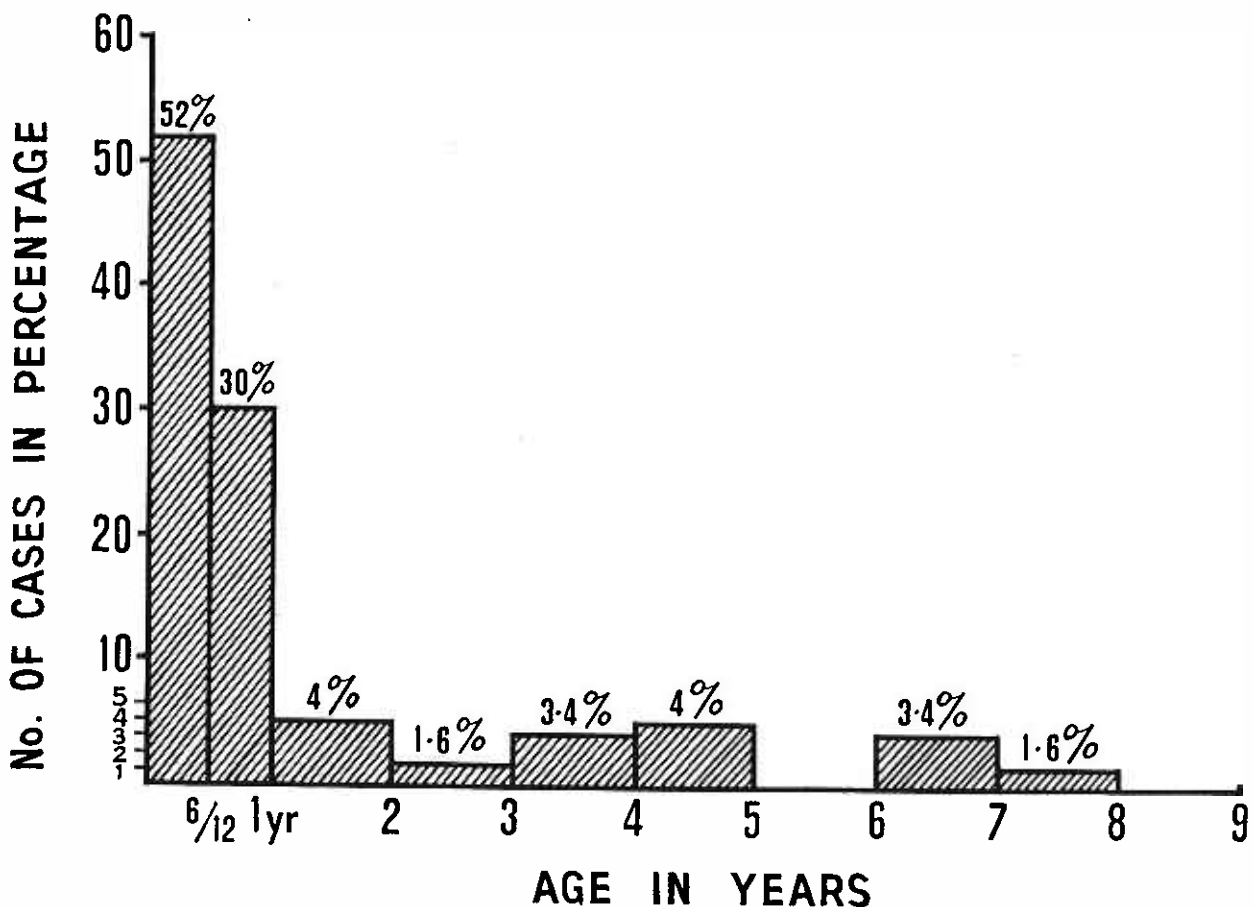


Fig. 1. Age incidence of purulent meningitis.

were given initially followed by oral Prednisolone ranging from 20 mgm - 40 mgm daily for a period of 2-3 weeks. As for antibiotics, majority of the cases received Chloramphenicol and Sulfadiazine. The Chloramphenicol was given parenterally initially and orally later on. 7 cases were given only Penicillin and Sulfadiazine. 15 patients had Penicillin added to their Chloramphenicol and Sulfadiazine, while 2 cases had a combination of Sigmamycin (Tetracycline and Oleandomycin) Chloramphenicol and Sulfadiazine. The dosages of Chloramphenicol vary from 300-800 mgm per day; Sulfadiazine 2-5 gm/day and Penicillin 2 mega - 4 mega units per day.

During the 3-year period 120 cases were treated, of which 32 cases were in the steroid group, 42 cases non-steroid group and 21 cases delayed steroid group. 25 cases died within 24 hours after admission and were not placed in any of the above 3 therapeutic groups, because none of them had passed the 24-hour period when cortico-steroids would have been given and moreover many of them died so soon after admission that the antibiotics were not given an adequate opportunity to attack the infective organisms.

The age incidence as shown in Fig. 1 revealed that 82% of the cases were seen within the first year of life, 62 cases or 52% of the cases fall within the first 6 months. There were 72 males as against 48 females.

RESULTS

Table I is a comparison of mortality between the steroid and non-steroid groups. The mortality in the steroid group was 19% as compared with 45% in the non-steroid group and 38% in the delayed steroid group. Excluding those cases that died within 24 hours of admission, the total mortality rate showed a decline from 38% in 1958 to 18% in 1960. One would also notice that in 1960 more cases were placed in the steroid group in contrast to 1958 where only 5/31 cases were given cortisone early.

Neurological sequelae were present in 4% of cases in the steroid group; 33% in the non-steroid group and 50% in the delayed steroid group (see Table II). The only case in the steroid group with neurological sequelae had right hemiplegia. The 7 cases in the non-steroid group were 3 right hemiplegics, 2 spastic diplegics, 1 hydrocephalus with spastic diplegia and 1 atonic type of cerebral palsy with recurrent fits. In the delayed steroid group the 6 cases were 3 spastic diplegics, 1 of which had recurrent convulsion; 1 generalised hypotonic; 1 hydrocephalus with spastic paraplegia and 1 left hemiplegic. The neurological sequelae were physical signs observed

and recorded when the patients were discharged. Where the records in the case notes were doubtful or incomplete, the patients concerned were called up and assessed by one of us (T.K.H.). 4 cases were placed in the unknown group because of incomplete case records and the patients could not be traced. The above were mainly physical sequelae whereas mental and emotional sequelae were not mentioned because of the short period of follow-up and also detail assessment of their intelligence were not performed. Also not included in the neurological sequelae were 8 cases of subdural effusion complicating the meningitis. Of the 8 cases, 3 were in the steroid group, 2 in the non-steroid group and 3 the delayed steroid group. A total of 18 cases were tapped for subdural fluid, and only 8 were positive.

DISCUSSION

The figures in Table I and II showed that the steroid group had a much lower mortality and neurological sequelae than the non-steroid group. The figures in the delayed steroid group cannot be compared with the other 2 groups because of the small number of cases. Nonetheless it is interesting to note that the administration of cortico-steroid late in the course of the illness could not bring down the mortality rate neither could it prevent or reverse any neurological sequelae. The high incidence of neurological sequelae 50% is obvious because many of the cases in this group already had physical signs of cerebral damage before the cortico-steroids were introduced.

Before one could reach the conclusion that cortico-steroids were responsible for the low mortality and morbidity, one has to analyse many other factors which can and do influence the mortality rate and neurological sequelae. The various influential factors are age groups, antibiotics, type of organisms cultured, and severity of illness on admission.

The mortality rate of purulent meningitis is highest in the neonates and younger infants. Our experience showed a mortality rate of 67% in the neonates, 37% in those infants between 1-6 months, 26% from 6 months to 1 year; 20% in the 1-2 years age group and 17% in those between 2-5 years of age. In view of the high mortality in the very young, the steroid and non-steroid group to be comparable must have approximately equal number of cases within the various age groups. Table III shows that within the first year of age the number of patients treated in the steroid and non-steroid groups are comparable. It is interesting to note that in the neonatal group, out of 4 cases treated with steroid

TABLE I. COMPARISON OF MORTALITY BETWEEN STEROID AND NON STEROID GROUP

YEAR	STEROID GROUP		NON STEROID		DELAYED STEROID*		DEATH WITHIN 24 HOURS		TOTAL DEATH AFTER 24 HOURS		
	Alive	Dead	Mortality% Alive	Dead	Mortality% Alive	Dead	Mortality% No.	No.	%	No.	%
1958	4	1	20	5	9	3	30	5/34	15	13/34	38
1959	4	1	20	13	7	4	57	9/41	22	12/41	29
1960	18	4	18	5	3	1	25	11/45	24	8/45	18
TOTAL	26	6	19	23	19	8	38	25/120	21	33/120	27

* Delayed Steroid==Steroid started after 5th day of admission

TABLE II. COMPARISON OF SEQUELAE BETWEEN STEROID AND NON STEROID GROUP

YEAR	STEROID GROUP		NON STEROID		DELAYED STEROID		TOTAL (+)VE SEQUELAE	
	(+)ve	(-)-ve	U.K.*	U.K.*	(-)ve	U.K.*	U.K.*	% (+)ve
1958	1	2	33	1	3	3	1	50
1959	0	4	0	4	8	2	0	66
1960	0	18	0	2	3	1	2	33
TOTAL	1	24	1	4	7	6	1	50

* U.K.==UNKNOWN.

only one died, whilst all the 4 cases in the non-steroid group were dead. In the 1-6 months age group there were 3/13 deaths in the steroid group while the non-steroid group had 9/14 deaths.

Every case of purulent meningitis is an emergency and requires immediate attention. Since adequate and correct antibiotic is one of the most important therapeutic agent in the management of purulent meningitis, it would be futile to compare the results of the steroid and non-steroid groups if different antibiotics were used in the two groups. In this series we found that all the patients were given a combination of Chloramphenicol and Sulfadiazine with the exception of 7 cases who were given only Penicillin and Sulfadiazine. Of these 7 cases, 3 received cortico-steroids and 4 had no steroid. Both groups had one death each. Among those who were given Chloramphenicol and Sulfadiazine, 15 cases had Penicillin added to the Chloramphenicol Sulfadiazine combination. Of these 15 cases, 9 had steroid (5 early and 4 delayed) and 6 had no steroid. Each group had 2 deaths. 2 cases were given Sigmamycin (Tetracycline and Oleanomycin) Chloramphenicol and Sulfadiazine. Both

were in the steroid group, and one of the two patients survived. On the whole the antibiotics given to the steroid and non-steroid groups are comparable.

Culture of organisms from the cerebral spinal fluid were positive in 40 cases. Although the number of cases where bacteria were isolated were small, one can see from Table IV that for each specific bacteria group there is no marked difference in the number of cases treated with and without steroid. Meningococcal meningitis has the best prognosis in this series as none of the cases died.

Generally speaking the more severely ill the child was on admission, the worse is the prognosis. Patients who were admitted in a moribund state usually had some neurological sequelae if they survived. Many of the 25 cases who died within 24 hours of admission were admitted in a moribund condition. In our analysis on the severity of illness on admission, we decided to use the state of consciousness as a criteria. Usually cases who were admitted in coma were considered seriously ill. In the steroid group, 21/32 or 66% of the patients were in coma on admission;

TABLE III. AGE GROUP COMPARISON BETWEEN STEROID AND NON STEROID GROUP

	STEROID GROUP		NON STEROID		DELAYED GROUP		MORTALITY %
	Alive	Dead	Alive	Dead	Alive	Dead	
Less than 1/12	3	1	0	4	0	1	6/9 = 67%
1/12—6/12	10	3	5	9	10	3	15/40 = 37%
6/12—1 year	10	2	12	3	1	3	8/31 = 26%
1—2 years	1	0	3	0	0	1	1/5 = 20%
2—5 years	2	0	2	1	1	0	1/6 = 17%
5+ years	0	0	1	2	1	0	2/4 = 50%
TOTAL	26	6	23	19	13	8	

TABLE IV. ORGANISMS CULTURED FROM C.S.F.

	STEROID GROUP		NON STEROID GROUP		DELAYED STEROID GROUP	
	Alive	Dead	Alive	Dead	Alive	Dead
HAEMOPHILUS INFLUENZAE	3	2	2	2	0	1
PNEUMOCOCCUS	4	2	3	2	1	1
STAPH AUREUS	2	0	2	1	0	1
STREPT HAEMOLYTICUS	0	1	0	0	1	0
MENINGOCOCCUS	1	0	2	0	1	0
B. COLI	1	0	0	1	0	1
SALMONELLA TYPHI	1	0	1	0	0	0

in the non-steroid group 25/42 or 60% and in the delayed steroid group 8/21 or 38%. Thus there is very little difference in the number of severe cases admitted in the steroid and non-steroid groups. We did not use length of illness before admission as a criteria for severity because in our experience we found that history from parents is less reliable than what one can see of the child's condition on admission.

Lepper and Spies using intravenous hydrocortisone as supplemental treatment in Acute Bacterial Meningitis found no difference in mortality rate between the steroid and non-steroid group. If anything, they had slightly more neurological complication and subdural effusions in the steroid group. They had 22 consecutive recoveries of patients with meningococcal meningitis treated with steroids and also had 27 recoveries out of 27 patients not treated with steroid. 5 patients with Waterhouse-Friderichsen Syndrome treated with steroid all succumbed. In an alternate case study of 23 patients with pneumococcal meningitis, they had 10 out of 11 survivals in the steroid group and 11 out of 12 survivals in the non-steroid group. Of the 3 cases with neurological complications, 2 received steroid therapy. Of the 57 cases of H. Influenzae observed, 28 treated patients survived as did 29 who did not receive steroids. Ribble and Braude treated 12 cases of pneumococcal meningitis with A.C.T.H. cortisone and hydrocortisone and had 11 survivals.

In contrast to Lepper's series, our study revealed that cortico-steroids not only brought down the mortality rate but also reduced the incidence of neurological sequelae. The difference is probably due to the fact that many of our patients were severely ill on admission as shown by a large percentage of patients being admitted in coma and also by a 21% mortality within 24 hours

of admission. In our cases the cortico-steroids were started only 12-24 hours after admission whereas in Lepper's series it was instituted on admission.

SUMMARY

The results of treatment of 120 cases of purulent meningitis with and without cortico-steroids were reviewed. The cases were divided into 3 groups, steroid, non-steroid and delayed steroid. Both the mortality rate and number of cases with neurological sequelae were very much lower in the steroid group than the non-steroid group. The figures in the delayed steroid group revealed that the administration of cortico-steroids late in the course of illness could not bring down the mortality rate neither could it prevent or reverse any neurological sequelae. The various influential factors such as age group, antibiotics used, type of organisms cultured and severity of illness on admission were discussed. The difference between our results and those of other workers were briefly mentioned.

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