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Intracranial hydatid disease.
Our experience at peripheral tertiary
care centre in India and review of
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Intracranial hydatid disease. Our experience at peripheral tertiary care centre in India and review of literature

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ABSTRACT

Background: Echinococcosis also known as hydatid disease is an endemic zoonotic disease with growing public health concern with an estimated financial burden of US Dollars 193,539,740 annually. Its definitive host being carnivores and man being an accidental intermediate host. The most common organ affected is the liver, the brain is involved in about 2% of cases. Intracranial hydatid carries high morbidity owing to pressure effect and a slow-growing hence the diagnosis is often delayed. Surgery is the mainstay of treatment; medical management being reserved for selected cases.

Materials and method: A retrospective analysis of all the cases of intracranial hydatid disease managed at our department was done from 2013 to 2020 and data were analysed.

Results: A total of 6 cases were found with an incidence of 1.33% of all intracranial space-occupying lesions during the study period with male to female ratio of 5:1, mean age at presentation 21.2 years, 4 out of 6 patient in the pediatric age group, cyst localised mainly in middle cerebral artery territory, mostly solitary but multiple in one case, all cases managed surgically with preoperative rupture in one case, recurrence noted in another one, Albendazole was given to cases only with rupture or recurrence.

Conclusions: Intracranial hydatid disease should be suspected in all non-enhancing cystic brain lesions especially in endemic regions and all patients should have preferably surgical excision using the "Dowling technique" with medical management reserved for inaccessible lesions, patients unfit for surgery, rupture and recurrent cases. Its high time when public health strategies should also be focussed on prevention and control of disease with appropriate measure at the community level.

INTRODUCTION

Hydatid is a Greek word meaning "a drop of water" [23]. Hydatid disease also known as echinococcosis is an endemic zoonotic disease, with studies showing it to be an increasing public health concern and can be regarded as emerging or re-emerging disease [22] with an estimated annual financial loss of US Dollars 193,539,740 [4]. It is known to occur in all continents and in at least 100 countries with much more frequency in South America, Australia, Middle East, and parts of North Africa than in Europe and North America [31]. The highest prevalence

Keywords
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of human hydatid disease in India has been reported from Andhra Pradesh, Saurashtra, and Tamil Nadu [25]. About 60-75% of affected patients are from paediatric age group [31]. Echinococcosis is caused by infestation of larvae of taenia echinococcus. The definite host in the life cycle are carnivores commonly dog and humans being the accidental intermediate hosts who are infected by the feco oral route or by direct contact. Liver is most commonly affected organ followed by lungs. The brain is involved in less than 2% of cases [20], and incidence of hydatid among all intracranial space occupying lesions is 1-2% only [29]. Intracranial echinococcosis is treated primarily by surgery using "Dowling technique" with proctoscolicidal drugs used to sterilize the cyst, decrease the chances of anaphylaxis, decrease the tension in the cyst wall, reducing the risk of spillage during surgery and the recurrence rate, recurrent cysts, multiple inaccessible cysts [12]. We present here a case series

of 6 consecutive case of intracranial hydatid disease successfully treated at our institute and literature about intracranial echinococcosis is reviewed.

MATERIALS AND METHODS

We retrospectively analysed six cases of intracranial echinococcosis managed at Department of Neurosurgery, Government Medical College, Kota from 2013 to 2020. A detailed recording of demographic profile of patients, presenting factors, risk factors, investigations, surgical procedure and its outcome, other treatment modalities and their follow up was made.

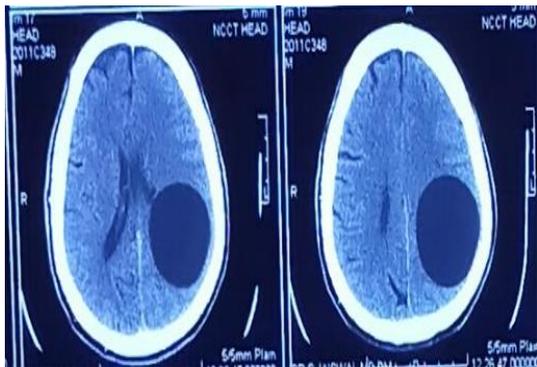
OBSERVATION AND RESULTS

An overall 6 cases of intracranial echinococcosis reported to our centre over the period and a total of 450 intracranial space occupying lesions operated during this period representing an incidence of 1.3% among all intracranial space occupying lesions. The details of patients recording are as given in Table 1.

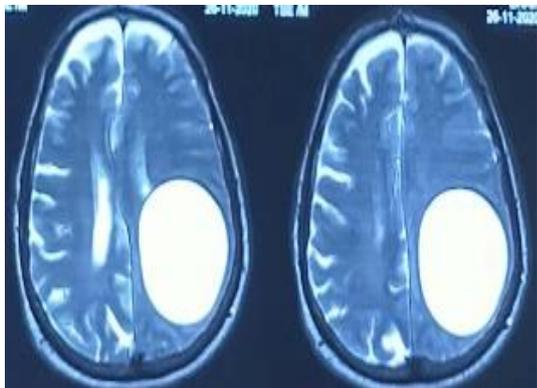
Table 1. Case details of patients with intracranial hydatid cyst.

Age/ Sex	Presentation and duration of symptoms	Location and number	Manage- ment	Recur- rence	Intra operati- ve rupture	Albenda- Zole	Risk factor
12y/ F	Headache, seizures, Right hemiparesis; 6 Months	Left temporoparietal , single	Surgery	No	No	No	History of contact to pets.
14y/ M	Headache, Vomiting, Left hemiparesis; 3 Months	Right temporoparietal , single	Surgery	No	No	No	No documented risk factor.
8y/ M	Headache, vomiting, seizures ; 1 Month	Left temporop- arietal, Multiple	Surgery	Yes	No	Yes [After surgery for recur-ence]	History of contact to pets.
31y/ M	Headache, Vomiting Reduced vision in right eye; 3 Months	Right mastoid region, Single	Surgery	No	No	No	No documented risk factor
5y/ M	Headache, Vomiting, Left hemiparesis; 3 Months	Right lateral ventricle, Single	Surgery	No	No	No	No documented risk factor
60y/ M	Headache, Right hemiparesis; 5 Months	Left Parietal, Single	Surgery	No	No	No	No documented risk factor

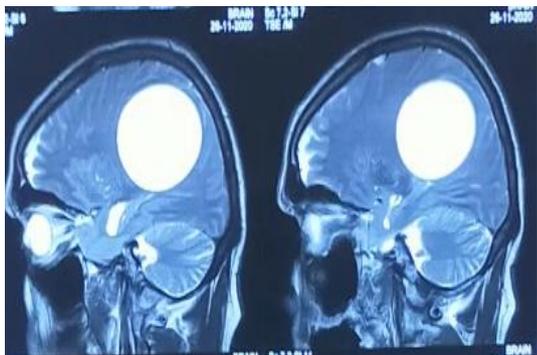
The mean age of presentation was 21.2 years and a total of 4 out of 6 [66.6%] patients were below 16 years. The mean duration of symptoms was 3.5 Months. There was a male to female ratio of 5:1. Two of the patients had history of contact with pets. All patients came from rural area of Rajasthan. The commonest presentation was headache present in all cases [100%] followed by vomiting and hemiparesis being present in 4 out of 6 patients [66.66%], seizures in 2 out of 6 patients [33.33%] and reduced visual acuity in one patient [16.66%]. The commonest location of cysts were in temporoparietal region with single cases each of intraventricular and infratentorial locations [Figure 1].



[a]



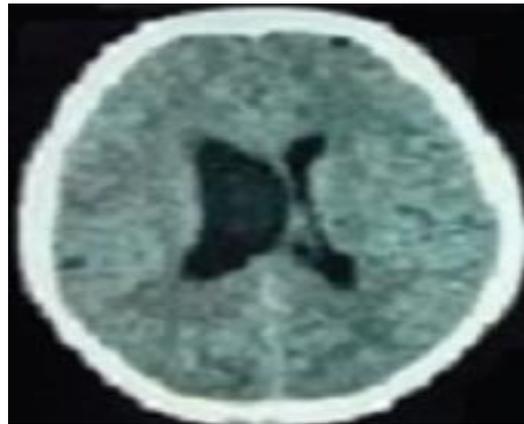
[b]



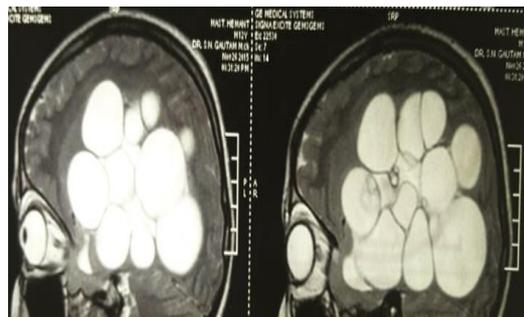
[c]



[d]



[e]



[f]

Figure 1. Pre-operative scans showing location of intracranial hydatid cyst [a] to [d] left temporoparietal, [e] Right intraventricular location, [f] Multiple intracranial hydatid cysts.



Figure 2. Delivery of intracranial hydatid cyst using Dowling's technique.

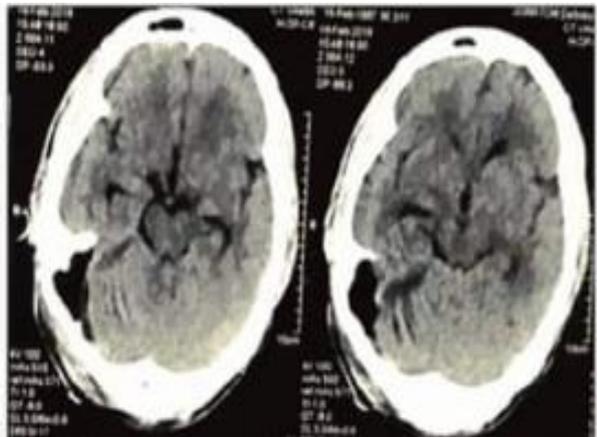
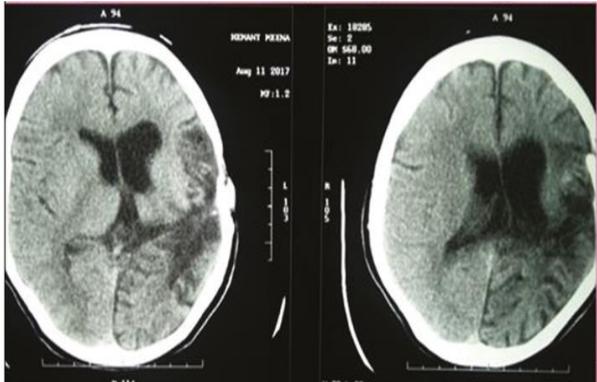


Figure 3. Post operated scans showing complete excision of cyst.

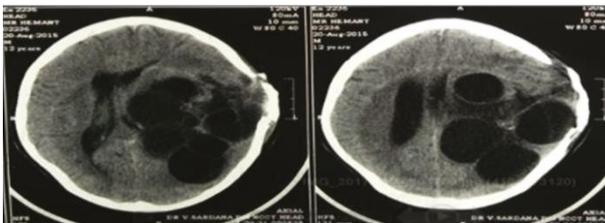


Figure 4. Recurrence in patient after 6 month of primary surgery.

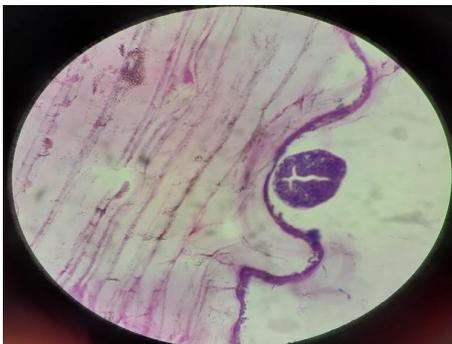


Figure 5. Histopathological microphotograph [40X] showing laminated ectocyst, scolex and inflammatory infiltrate.

Only one patient [16.66%] presented with multiple cysts [Figure 1f]. All patients were undergone a plain CT brain followed by an MRI brain to exactly localise the cyst, looking for consistency, number and status of surrounding brain parenchyma. The search of cyst located in other body organs using X ray chest and USG abdomen revealed no other associated cyst. All patient underwent craniotomy and cyst excision after routine investigations and anaesthesia clearance. We did not carry out serological investigations to test presence of antigen as it has less probability to be positive in intracranial hydatid disease and adds no significance to the management. All patients received a peri operative coverage of steroids for the risk of intraoperative rupture and dissemination. An adequate craniotomy was made as per the location of cyst, cyst was approached via corticectomy of size at least three fourth of size of cyst. The cyst was delivered through Dowling's technique dissecting peri cystic plane using hydro dissection and lowering the head end of table [Figure 2]. There was an intraoperative rupture of cyst in one case. Complete excision of cyst were achieved in all cases [Figure 3]. No intraoperative anaphylaxis was noted in any case. One patient developed extradural hematoma at craniotomy site in post operative period which was successfully managed conservatively. All excised cysts were subjected to histopathological confirmation which were consistent with hydatid cyst. There had been recurrence reported after 6 months of primary surgery in one case who was then operated at some other centre for recurrence but developed recurrence again after second surgery and later operated again at our centre only [Figure 4]. Cases who had rupture during surgery and recurrence following surgery were given tablet albendazole in divided doses of 10 mg/kg/day for a 28 days cycle followed by 14 days drug free interval upto 4 cycles. There has been a constant and good recovery of neurological symptoms in all cases. All the cases have been in follow up over a variable period of 6 months to seven years, we have a protocol of having post operated CT brain in immediate post operated period, an MRI brain at three months and one years of follow up.

DISCUSSION AND REVIEW OF LITERATURE

Hydatid disease is an emerging zoonotic parasitic disease, cases have been reported in all continents and across 50 countries around the globe. The countries with higher prevalence included Mediterranean countries, middle east countries, Russia, Australia, New Zealand, France, China, India [1]. The worldwide incidence of echinococcosis has been estimated to be 100,000 – 3,00,000 cases annually but only about 2-3% cases are of intracranial echinococcosis which actually may be higher but underreported [25, 12]. Guesnar reported first case of cerebral hydatid [9]. Intracranial hydatid forms about 1-2 % of all intracranial space occupying

lesions [21], the ratio in our series reported to be 1.33% of all brain space occupying lesions operated during this period. The majority of cases about 65-80% found in paediatric age group possibly because of patent ductus arteriosus [9,14], in our series 4 out of 6 patients [66.66%] were under 15 years of age. No patent ductus arteriosus was found in any of our patient. There has been a male preponderance which was seen in present series also.

In Indian context, lot of single case reports are there on intracranial hydatid cyst, we found two case series of nine cases by Tanki et al [29] and five cases by Gupta et al [14] and compared the results with present series [Table 2].

Table 2. Comparison of results of case series by Tanki et al [29] , Gupta et al [14] and current Series

	Tanki et al [2009-2015]	Gupta et al [1984-1997]	Current Series [2013-2020]
Number of cases	9	5	6
Incidence in terms of Percentage of total intracranial space occupying lesion	0.06%	0.05%	1.13%
Mean Age of presentation	11.5 years	13.4 years	21.2 years
Paediatric patients	9/9 [100%]	4/5 [80%]	4/6 [66.66%]
Duration of symptoms	1 Month to 2 years	1 Month to 2 years	1 Months to 6 Months
Male : female ratio	5:4	3:2	5:1
Risk factors			
1) Contact to pets	7/9	2/5	2/6
2) Rural location	8/9	3/5	6/6
Symptoms	Seizures [Most common], Hemiparesis, Vomiting and Headache	Hemiparesis [Most common], Seizures	Headache [Most common], Hemiparesis, Vomiting, Seizures
Location of cyst	Four parietal solitary cysts, two frontal solitary, one parietooccipital solitary, two parietal multiple cysts	One patient each with frontal, lateral ventricle, parietal. Two patients with multiple cysts in parietal and temporoparietal region.	Two patients each with temporoparietal solitary cyst, one with lateral ventricle, one parietal, one mastoid, one with multiple temporoparietal cysts
Intraoperative Rupture	3 cases	2 cases	1 case

Anaphylaxis following rupture	Nil	Nil	Nil
Recurrence	Two cases; One year of surgery	Two cases; six month to one year after primary surgery	One case, 6 months following surgery
Albendazole	To all patients following surgery, 10 mg/kg for two months	To two patients following recurrence, 10 mg/kg for one month	Two patients, one with rupture another with recurrence, 10mg/kg upto 4 cycles
Follow up period	6 months to five years	Six months to eight years	Six months to seven years

Echinococcosis is caused by larvae [metacestode] of cestode species of the genus *Echinococcus* like *E. granulosus* [cystic echinococcosis], *E. multilocularis* [alveolar], *E. vogeli* or *E. oligarthus* [polycystic echinococcosis]. The two most common affecting humans are *granulosus* which has a limiting membrane and *multilocularis* with no limiting membrane and hence grow aggressively [23,25]. At least 7 of 9 strains of *E. granulosus* are found to be infective in humans with G5 strain responsible for most cases globally while G1 and G5 causes most infections in India [25].

Humans being the accidental intermediate host, get infected through the faeco oral route by ingestion of food or milk contaminated by dog faeces containing ova of the parasite or by direct contact with dogs. The eggs loose their enveloping layer in the stomach, releasing the embryos. The embryos pass through the wall of the gut into the portal system and are carried to the liver where most larvae get entrapped and encysted. Some may reach the lungs and occasionally, some may pass through the capillary filter of the liver and lungs and get entry into the systemic circulation. These may even reach the brain. Commonly affected organs include liver, lungs, brain, spleen, kidney, orbit, musculoskeletal system [23,11,13]. Contact to pets may or may not be always present, it was there in two of our patients. All the patients of our series were from rural area where there are large open areas and contamination of soil with stray dog's faeces is a common occurrence which is in accordance with the hypothesis of significant environmental contamination where in parasite eggs can survive longer in conditions of high humidity [32].

Intracranial hydatid cyst may be primary [single] with multiple scolices and broods capsule hence fertile with a risk of recurrence following rupture while secondary [multiple] thought to arise from multiple scolices released from left side of heart or

cyst rupture in heart, lacks broods capsule hence non fertile with negligible risk of recurrence following rupture [12,1,14,26]. In cerebral tissue most common location of hydatid disease is in territory of middle cerebral artery which was also seen in our series where 4 out of 6 locations were in territory of terminal branches of middle cerebral artery [23,12,14]. Intraventricular location is now being reported in literature more and more as has been reported by Sharad *et al* [23], we had one patient with lateral ventricle hydatid cyst and contrary to common supratentorial locations [12,14] we had one patient with hydatid cyst located in right mastoid region. Other locations of intracranial echinococcosis reported in literature are orbit, skull bones, pons, basal ganglia [10,27].

The usual clinical presentation may be signs of raised intracranial pressure more common in paediatric population or focal neurological deficits common in adults [12,14]. Headache was commonest presentation in present series in all cases followed by vomiting, hemiparesis and seizures.

The diagnosis of intracranial hydatid relies on radiological investigations. On CT head, there is hypodense non contrast enhancing oval homogenous cystic mass lesion with thin walls and smooth margins usually in territory of middle cerebral artery with pressure effect on surrounding brain parenchyma as per the size of lesion with no surrounding edema [10,30]. Usually upon diagnosis the lesions are of considerable size before symptoms appear as intracranial hydatid cyst is a slow growing lesion although a variable growth rate of 1-10 cm/year has been documented in literature [23,9,14,28].

On MRI brain, cyst wall has low signal intensity on both T1 and T2 imaging with no enhancement, daughter cysts or hydatid sand may be visible on MRI, no rim enhancement is a differentiating feature from cystic high grade tumours or abscess [10,30]. Infiltrating margin and surrounding edema may be a

feature of echinococcus multilocularis. MRS and diffusion weighted imaging has now being used to further aids to diagnosis. Chand et al [7] demonstrated mildly elevated choline, depressed creatine and NAA, and a large peak of lactate, pyruvate and acetate. Pyruvate has been considered a specific in vivo marker for cestodal, in particular hydatid cysts [7,19,17,35]. All patient underwent CT brain followed by MRI brain in current series and pre op diagnosis of Hydatid cyst was considered in all cases was considered based on consistent radiological findings. No patient in current series was subjected to MRS. The various differential diagnosis to be considered on radiology should include cystic tumours, porencephalic cysts, arachnoid cysts, epidermoid cysts, neurocysticercosis, toxoplasma [23,30,5].

Among serological tests immunoblot test is the test of choice targeting the specific arc 5 antigen present in hydatid fluid of E.granulosus. The sensitivity and specificity of test is 91% and 98% respectively. It may show cross reaction with Taenia cysticercosis. Casoni's test is of little significance in cerebral hydatid disease [23, 22]. No patient in current series was subjected to any laboratory investigation to ascertain hydatid disease pre operatively as radiological findings were typical of disease.

The treatment of choice for intracranial hydatid disease is surgical excision of cyst without rupture [16]. The preferred technique includes the Dowling technique later modified by Arana Iniguez and San Julian. The essential steps include creation of a large flap; careful handling during all operative steps to avoid monopolar coagulation; opening the atrophic cortex overlying the cyst over an area with a diameter no less than three quarters of the diameter of the cyst; and allowing the cyst to fall out by just lowering the head of the operating table and flushing warm saline between the cyst and surrounding brain [6,2]. In case of multiple cyst, largest one is targeted first. No technique can be applied to all the cases as a general rule and there should be an approach pre operatively identified for each case [16]. We got a complete resection of cyst in all the cases under microscopic guidance, although rupture was there in one case but no anaphylaxis was seen. There have been reports of irrigating the cavity with hypertonic saline to prevent recurrence specially after inadvertent intra operative cyst rupture [26,33].

There may be post operative cerebral edema, sub

dural effusions, hydrocephalus, loss of autoregulatory mechanisms following cyst excision and decompression which should be suspected and diagnosed timely [23,15]. No such complication was seen in our series. Although an underlying EDH at craniotomy site was seen in one case which was successfully managed conservatively.

The pathological character of cyst consists of three layers the endocyst which has inner germinal layer, scolices, brood capsule which proliferate by internal budding. In E. multilocularis there is external budding and hence infiltrating margins are there. The ectocyst the outer laminated layer, the host inflammatory capsule Pericyst which has blood vessels to supply nutrition to the parasite [23,9,14]. All cases were subjected to histopathological confirmation in current series with confirmation of all the layers in the specimen. [Figure 5]

The medical management consists of protoscolicidal agent Albendazole in divided doses with a total dose of 10 mg/kg/day. It is parasiticidal and acts by blocking the uptake of glucose by larvae and adult parasites [18]. Albendazole results in disappearance of up to 48% of cysts and a substantial reduction in size of the cysts in another 28% [26]. Praziquantel increases the serum concentration of Albendazole four fold and hence a combination of drugs is more effective than either alone [23,26]. The use of drugs is limited to patient not fit for surgery, inaccessible cyst, history of intraoperative rupture, recurrence. The drugs are given over a 28 days cycle with 14 days drug free interval upto 4 to 6 cycles [12,15]. Although isolated case reports of medical management of intracranial echinococcosis are there in literature [24,8]. In the current series two patients one with recurrent disease and another with intraoperative rupture of cyst were put on albendazole upto 4 cycles after surgical excision and no recurrence has been documented till now in regular follow up.

Hydatid disease is an emerging and reemerging public health problem where surgical and medical management of individual cases is just a palliation and a public health strategy to control and prevent the disease is reasonable approach. Each country need to identify the prevalent strain, definitive and intermediate host in her geographical location and derive policies accordingly. As far as India is concerned, checking the population of stray dogs, surveillance of dogs, periodic stool testing and

accordingly treatment, preventing direct access to raw offal at slaughter house and farms should be implemented. Many countries such as New Zealand, Australia, and China have been successful in this regard and India is yet to catch up^[31,34].

Despite a silent but constantly growing public health concern and growing number of intracranial hydatid disease, there has been a need of more and more literature to better manage the cases of intracranial echinococcosis and also to address this entity on community level also. Through this series we have shared our experience of successful management of intracranial echinococcosis and also adds on to a complete literature review over this under reported cerebral disease.

CONCLUSIONS

Hydatid disease should be suspected in all cystic non enhancing mass lesions specially in endemic regions and goal of treatment should be complete surgical excision with no rupture of cyst while reserving albendazole for selected cases, alongside addressing this condition on community level also with incorporation of carefully drafted public health policies.

DECLARATIONS

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Conflict of interest: Nil

Consent: Proper consent has been taken from all patients and their legal guardian to use their data for academic publication with assurance of non-disclosure of identity to the best of the extent.

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