Endonasal Endoscopic Approach in Management of Paediatric CSF Rhinorrhoea Cases

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Abstract Though endoscopic repair has been the proven to be the gold standard for the repair of cerebrospinal fluid rhinorrhoea in adult patients, the type of approach to be used in paediatric patients especially those below 5 years is still a challenge with no clear cut guidelines. The objective of this study was to evaluate the efficacy of using endonasal endoscopic approach for treating paediatric patients aged less than 5 years diagnosed with cerebrospinal fluid rhinorrhoea. This was a retrospective analysis of five cases of paediatric CSF rhinorrhoea operated in a tertiary health care centre with an age of less than 5 years from October 2002 to September 2010. All the five cases treated by endoscopic approach have no further complaints of CSF leak or meningitis with a follow up period of a minimum period of 6 months. Two cases were further detected to have meningocele and meningoencephalocele which was detected preoperatively and treated by reduction and excision respectively. The good results obtained by endoscopic closure with lack of major complications and the decreased morbidity for the patient suggests that the endoscopic approach should be considered the first line of approach in pediatric population. But we would warrant a

careful selection procedure and availability of adequate expertise for this approach to avoid complications.

Keywords Paediatric CSF rhinorrhoea · Cranionasal fistula · Endoscopic management of CSF rhinorrhoea · Extracranial repair

Introduction

Cerebrospinal fluid rhinorrhoea (CSF) can occur due to a defect in either skull base, paranasal sinuses or the temporal bone through the eustachian tube. It usually occurs due to a breach in the bone, dura and the arachnoid meningeal layers [1]. There have been numerous efforts to classify CSF rhinorrhoea with numerous authors using different factors for classifying CSF rhinorrhoea with each factor having its own importance in the prognosis of the treatment. Cairns [2] classified CSF rhinorrhoea into four categories: acute traumatic, delayed posttraumatic, operative, and spontaneous. Ommaya et al. [3] further divided traumatic CSF rhinorrhoea into accidental and iatrogenic types and nontraumatic CSF rhinorrhoea into high-pressure leaks and normal pressure leaks. In over 80 % of traumatic cases, head injury resulting in skull base fracture is implicated as the common cause [4, 5]. The surgical management is warranted usually only after a trail of conservative management which includes bed rest, head end elevation, multiple lumbar punctures/drain, diuretics and acetazolamide. The surgical management is considered only after failure of the conservative management.

The surgical management consists of either an intracranial or an extra cranial approach. The initial rate of successful repair of CSF rhinorrhoea by intracranial approach by Dandy [6] as early as 1926 was up to

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60–80 %. Though extra cranial approach for duraplasty was described by Dohlman [7] in 1948, it was popularized by Hirsch [8] in 1952. Vrabec and Hallberg [9] in 1964 described the endonasal approach for closure of defects in sphenoid sinus and cribriform plate, since then endonasal endoscopic approach has evolved a lot, with the recent literature quoting a success rate of up to 90 % [10, 11] it has become the initial treatment of choice for CSF rhinorrhoea repair. But excepting for one case series [12] of paediatric cases with CSF rhinorrhoea with a success rate of 96 %, rest all literature consists of only individual case reports [13, 14]. Due to the paucity of literature no specific criteria or consensus is available with regards to management of paediatric patients, specifically in the below 5 years age group. The importance of considering paediatric age group separately is due to the narrow nasal passage of children which renders them more susceptible to complications [15] and also the developing anatomy provides a variable anatomy which requires an experienced personnel with adequate expertise. Also the possibility of treating encephaloceles (congenital) as a cause is also high, making the endoscopic approach much more complex. In the past, timing of repair had been focused on for allowing adequate time for facial growth (2–3 years) to help facilitate instrumentation and endoscopic visualization of the Sino nasal cavity and skull base. However, this must be counterbalanced against the risk of ascending meningitis and CSF leak [16], which can become life threatening. These differences highlight the extra cautious approach required in managing paediatric cases surgically and also accept the possibility of having variable success rates as compared to the adult population treated endoscopically. Our study hopes to assess the efficacy of using endoscopic approach for treatment of paediatric patients.

Materials and Methods

This was a retrospective analysis of cases of CSF rhinorrhoea operated in Department of Otorhinolaryngology and Head & Neck Surgery, AIIMS Delhi with an age of less than 5 years from october 2002 to sept 2010. All patients who failed a trail of conservative management were referred to our institute for evaluation and possible surgical management. The diagnosis was ascertained by history, nasal fluid analysis (glucose, chloride, protein & cell count) & radiological evaluation, including contrast enhanced computed tomography of paranasal sinuses & magnetic resonance imaging (MRI). After the diagnosis was confirmed patients were admitted and informed written consent was obtained for both endoscopic and external approach. Patients were given hypotensive general anaesthesia with a 15–20*

head end elevation. Nasal cavities were decongested with 1:100,000 xylocaine in adrenaline and the site of leak was confirmed intraoperatively by anaesthetist induced positive pressure ventilation. 2.7 mm 0* and 30* endoscopes were used for the surgery. In patients with narrow nasal cavities partial middle turbinate resection was done for exposure. The defect was identified, margins freshened and the defect closed in four layers using fascia, muscle, minced fat obtained from abdominal incision and gelfoam. Excepting one case where fascia lata was used, in all other cases rectus fascia was used along with rectus abdominis muscle and fat. Otological instruments such as circular knife and granulation forceps were used in the procedure for the ease of maneuverability. Anterior nasal packing was done in all cases & pack removal was done on the third postoperative day. Lumbar drain was not utilized in any of the cases in contrary to adult cases in view of the discomfort and non-compliance expected in pediatric patients. Patients were instead initiated on inj. Mannitol for 5–7 days and Tab. Acetazolamide for 4–6 weeks along with I.V antibiotics (3rd generation cephalosporins), antihistaminics, stool softners, cough suppressents and were confined to bed rest. All the cases were followed up for a minimum period of 6 months.

Results

In the study a total of five cases were included with age less than 5 years (14 months to 5 years), with a mean age of 3.4 years. The youngest child was 14 months old and according to our knowledge this is the youngest age to be reported in literature. The Male:Female ratio was 4:1. The complete details of the individual cases are expressed in Table 1.

In four patients (80 %) there was a prior history of blunt head trauma, where as in one patient there was a congenital meningoencephalocele. The average duration of CSF leak was 10.6 months, but only one patient had history of meningitis (20 %). Only one patient had a history of headache, but reservoir sign was seen in all the five patients. All patients underwent C.T and M.R.I scan, where the defect was localized in the roof of ethmoids in four cases with an additional evidence of 24 × 11 mm cystic lesion in the ethmoidal roof dehiscence seen in the one case of congenital meningoencephalocele. All patients underwent endoscopic repair of the defect under general anaesthesia, with partial resection of the middle turbinate. Using otological instruments the defect was delineated & repaired in four layers in all the cases & the repair was further augmented with fibrin glue only in one case done initially. As mentioned previously all excepting one case was

Table 1 Individual patient profile

Age	Sex	Side	Site	Duration (months)	Nature	Etiology	Meningitis
5 years	M	Left	Fovea ethmoidalis	2	Continuous	Post traumatic	Nil
5 years	M	Left	Cribriform plate	42	Intermittent	Congenital (meningoencephalocele)	Yes
3 years	M	Right	Cribriform plate	6	Intermittent	Post traumatic	Nil
14 months	M	Right	Cribriform plate	2	Intermittent	Post traumatic	Nil
3 years	F	Right	Cribriform plate	3	Intermittent	Post traumatic (revision)	Nil

repaired with rectus fascia. In two cases brain tissue herniation was also seen. In the patient who had post-traumatic CSF rhinorrhoea with meningocele, the meningocele was reduced by cauterizing the tissue and repairing the defect, but in the other case which was a congenital meningoencephalocele, the tissue was excised and the defect was repaired. In all cases the effectiveness of the repair was tested intraoperatively by positive pressure ventilation. The average time period for discharge of the patient was 8.25 days with a range between 7–10 days. One complication was encountered on post-operative day1 in the fifth case of a small hematoma at the site of abdominal incision, which was drained immediately. Period of minimum follow up was 6 months and till date all the cases have no evidence of any recurrence or further episodes of meningitis Fig. 1.

Discussion

The increased incidence of road traffic accidents has contributed significantly for the increased number of cases of CSF rhinorrhoea. History provided by the patient and the nasal fluid analysis are the initial diagnostic tools to suspect CSF rhinorrhoea, specifically the history of recurrent meningitis. Radiological investigations like contrast enhanced C.T and MRI scan help in confirming the diagnosis and also help in localizing the site of the defect. Though $\beta 2$ Transferrin detection in nasal fluid is considered diagnostic for CSF, we could not perform this test due to the lack of facility for the same. But the investigative work up performed proved to be adequate and no false positive or false negative cases were encountered. All the patients need to be given a trail of conservative

Fig. 1 C.T and M.R.I scan of a 14 month old baby with post-traumatic CSF rhinorrhoea along with meningocele. **a** CT scan depicting the site of bony defect (*White arrow*). **b** MRI scan showing the site of defect in the Skull base (*Black arrow*). **c** MRI scan showing the site of dehiscence with collected fluid in the ethmoid sinuses (*Black arrow*). **d** MRI scan showing the presence of meningocele in the nasal cavity through the skull base defect (*White arrow*)

management to look for any spontaneous recovery as has been quoted by Jones et al. [17] in their study of CSF fistulae in children, they reported that 19 (70 %) of 27 children healed spontaneously and that spontaneous healing is most likely to occur within 7 days. Use of fluorescein (0.1 ml mixed with 5 ml of CSF and injected back into the subarachnoid space) is an excellent method of demonstrating the site of a leak intraoperatively but large doses of intrathecal fluorescein should be avoided as neurological complications such as seizures, lower extremity weakness and numbness have been reported [18]. So we avoided using it in our patients even though it is a very effective measure. There are usually six main locations of the skull base defect, these include the sella, sphenoid sinus, ethmoid roof, olfactory cleft, frontal sinus/recess and middle cranial fossa [19], the most common being ethmoid roof as is also seen in our series. Though the literature mentions a definitive role of lumbar drain especially in high pressure leaks and in cases of large dural defects [20–22], we did not use it in our paediatric patients to avoid discomfort and displacement, as it would be hard to control the child's activities when the child is already irritated by nasal packing and also to decrease the ICU stay. We instead started patients on mannitol injection and Acetazolamide tablets to maintain a decreased CSF pressure. With the excellent success rates of endoscopic repair in adults, endoscopic approach has become the initial approach of choice, but in paediatric population the narrow nasal cavity and the developing anatomy with inadequate exposure of the defect has always tilted the balance in favour of an external approach. Many manoeuvres such as resection of middle turbinate, uncinctomy and displacement of septum have been described to improve exposure, but in our study partial resection of middle turbinate was adequate enough for good exposure and further use of smaller otology instruments gave us adequate space for working in the narrow nasal cavities [13]. With the results of previous studies and also ours (100 %) which show a good success rate with endoscopic repair, we could warrant endoscopic approach to be the initial choice even in paediatric population. Furthermore, the lack of impact of paediatric sinus surgery on long-term facial growth has been well documented in the literature [23], which further augments our stand. Multiple techniques have been reported in the literature advocating underlay, overlay, cartilage or bone, fat plug, fascia, AlloDerm and fibrin glue [16], individual authors have their own preferences and reasons. In our study we used abdominal incision to harvest fat, fascia and muscle in three patients and fascia lata in one patient, with equally good results. Mattox and Kennedy [13] had suggested that the mucoperichondrial flap from nasal septum is less preferable as it has a tendency to contract and thus get displaced, thus making it a less preferable option in large

skull base defects. It has also been postulated that an endoscopic approach may not be successful in cases with multiple defects or where the defect is not well defined [24] and Infection or severe inflammation within the nasal cavity can also make endoscopic repair a difficult option, so a preoperative work up and prophylactic antibiotics do have a major role in the management of these patients especially in paediatric age group [25]. Causes of failure have always been a topic of controversy, but according to a study by Wise et al. [19] increased intracranial pressure usually associated with spontaneous leaks have a poor prognosis and also the fact that these leaks are usually from the lateral recess of sphenoid which is more difficult to treat. They also postulated that a prior history of craniotomy, suggestive of a possible large defect, poor wound healing such as after radiotherapy and secondary surgeries are associated with poorer results. In a study by Zweig et al. [26] they felt that the size of skull base defect did not affect the outcome of repair.

Conclusion

Thus with the good results obtained by endoscopic closure and the lack of severe complications with decreased morbidity as compared to other approaches, endoscopic approach can be also considered the first line approach as in adult population, but we would warrant a careful selection procedure and availability of adequate expertise for this approach. However further long term studies with larger sample size is required to test the hypothesis.

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