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Trans-frontal extracranial approach in repair of cerebrospinal fluid fistula

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Summary

A 35year old African woman presented with a 2 year history of unilateral watery left anterior rhinorrhoea, the only other significant feature being a history of severe head injury during childhood. Clinical and radiological evaluation confirmed a cerebrospinal fluid fistula, localized in the inferior portion of the posterior wall of the frontal sinus and ethmoid, no intracranial pathology. Repair was done successfully with a deep temporalis fascial graft through an external transfrontal approach. We report this to buttress the current trend in which less invasive external and endoscopic techniques are replacing intracranial methods. Reduction in morbidity and mortality which are the merits of this technique are emphasized and the management is discussed.

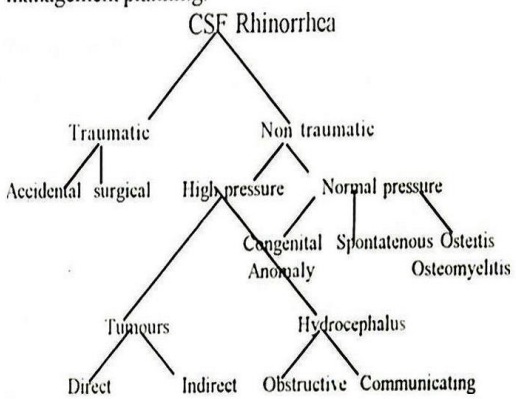
Keywords: *CSF fistula, rhinorrhoea, external transfrontal approach, Deep temporalis fascia.*

Résumé

Une vielle femme africaine agee de 35 ans avait une histoire de 2 ans de la rhinorrhée unilatérale anterieure gauche enflée, ayant une histoire de blessure de tete sévére dans l'enfance.L'évaluation clinique et radiologique confirmait le fistule du fluide cérebro-épiniére localisee dans la portion inférieure de la surface postérieure du sunise frontal et éthmoidal et aucune pathologie intracraniale.La reparation était faite avec succés avec un graffage facial du temporalis profond par l'approache external transfrontal. Nous reportons pour supporter le train current ou non des techniques invasine externe et endoscopique replacent les méthodes intracranial. La réduction de la souffrance et de la mortalité comme des avantages de cette technique sont illuminées et le ménagement est discuté.

Introduction

CSF rhinorrhoea is a rare cause of a common complaint – clear, watery rhinorrhoea, although there are no large series documenting the exact incidence. The great majority of cases are caused by trauma (90%) [1,2]. The nontraumatic can be primary, in which the intracranial pressure is normal, often due to congenital defects; and secondary, in which the intracranial pressure is elevated, often following tumours and hydrocephalus. The classification proposed by Ommaya AK [3] is given below. It describes the actiopathogenetic factors and this is useful in management planning.



Classification of CSF rhinorrhoea - Ommaya AK [3]

Whatever the actiology, the common pathology is a disruption of the dura – arachnoid mater coupled with an osseous defect [1,4]. The most common anatomic sites of the defect are the areas of congenital weakness of the anterior cranial fossa and areas related to the type of surgery performed [1,2,4].

Diagnosis is made by a history of unilateral rhinorrhoea following a trauma, confirmation of cerebrospinal fluid and imaging techniques to identify the site and size of the leak; and anatomy of the brain parenchyma. All these largely determine the choice of surgical approach.

CSF is indicated if there is non stiffening of the handkerchief after drying of the fluid (confirms absence of nasal mucus)or presence of a halo sign (a central area of blood staining surrounded by clear ring) [4,5,6]. The presence of glucose in CSF is confirmed using Glucose oxidase – impregnated test strip. A false positivity can occur with this test due to the glucose content in nasal mucus, less than 5mg/dL. However, confirmation is done by estimating glucose concentration in CSF which is not less than 30gm/dL [5,6]. Immunofixation electrophoresis to identify beta 2 transferin in CSF is confirmatory. This is a protein produced by the activity of neuraminidase in the brain and it is unique to CSF and perilymph [5,6]. Radiological investigation to confirm the leak include plain x – rays, CT Scan, MRI, positive contrast CT Cistenography using metrizamide, iopamidol or iohexol and PET Scan [1-4].

Until recently the intracranial approach has been the standard. While this approach affords the direct inspection of the adjacent cerebral cortex, visualization of the dural defect, and better ability to seal the leak, the disadvantages

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include increased morbidity, increased risk of permanent anosmia, trauma related to brain retraction and longer hospital stay [1-4]. With the development of the extracranial approaches, these complications are minimised. The extracranial techniques can be endoscopic or external. The approaches include an anterior osteoplastic flap through a bicoronal or eyebrow incision, external ethmoidectomy, transethmoidal sphenoidotomy, transseptal sphenoidotomy, and the transantral approach [5,6]. Graft material choices include fascia lata, temporalis fascia, septal or turbinate mucosa, muscle, fat, and septal cartilage [5].This CSF fistula was repaired through the external trans-frontal approach using deep temporalis fascia graft.

Case

A 35 year old African lady presented with a two year history of recurrent watery and clear left anterior rhinorrhoea. The rhinorrohoea was precipitated by stooping or bending. There was no associated headache, nasal obstruction, allergy or symptoms suggestive of intracranial pathology. There was a remote history of head trauma (in childhood, about 20 years previous) associated with loss of consciousness for 2 days.

Examination revealed reservoir sign in the left nasal cavity (Figure 1). This is elicited by positioning patient from supine to an upright sitting position with the neck flexed for about 10 minutes. Drops of clear and colourless fluid was seen coming from the left nasal cavity.

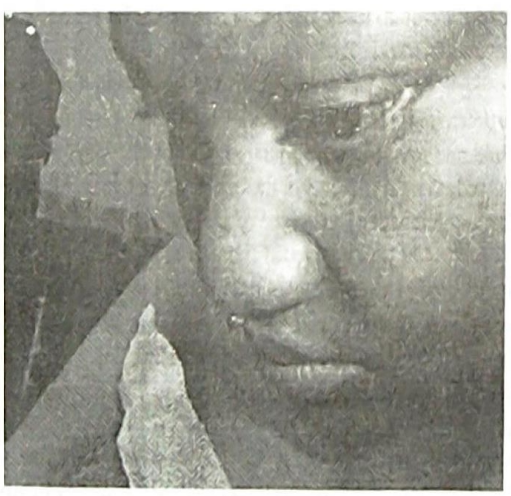

Fig. 1: Antero - posterior view of the face of the patient showing reservoir sign.

The fluid was found to be clear on a white handkerchief. After drying of the fluid, there was no stiffening of the handkerchief (White Handkerchief test).

Plain radiograph and CTScan of the paranasal sinuses revealed a linear fracture of the posterior table of the frontal sinus with normal architecture of the brain substance. All the other investigation parameters were normal

Under general anaesthesia and endotracheal intubation, the deep temporalis fascia was harvested via a longitudinal vertical incision above the left superior root of the pinna into the hairline (Figure 2). A curved vertical incision, 2cm, was made on the left eyebrow extending to the medial canthus(Figure 2) and the left frontal sinus was accessed through a fenestration by drilling of the anterior table. The bony defect about 0.5cm diameter was noted on the lower half of the posterior wall of the frontal sinus and the posterior ethmoidal sinus with dural herniation. The dura was reduced into the cranial cavity and the defect was patched with the deep temporalis fascial graft and surgicele. The incision was closed in layer with 3 – 0 chromic and silk sutures.

Postoperatively analgesics(Pentazocine^{R} and Novalgin^{R}) and antibiotics (Augmentin^{R} and metronidazole) were commenced. The others included bed rest with the patient in a head-up position and avoidance of strain such as coughing, sneezing, nose blowing, and heavy lifting.

There was absence of reservoir sign at third postoperative day (Figure 2). The stitches were removed from the two wounds (temporal and eyebrow) and the patient was discharged home on 3rd postoperative day. Follow-up of the patient over one year after surgery still confirms resolution. There was no feature suggestive of any intracranial complication. The facial scar was barely noticeable and the cosmetic appearance was acceptable to the patient.

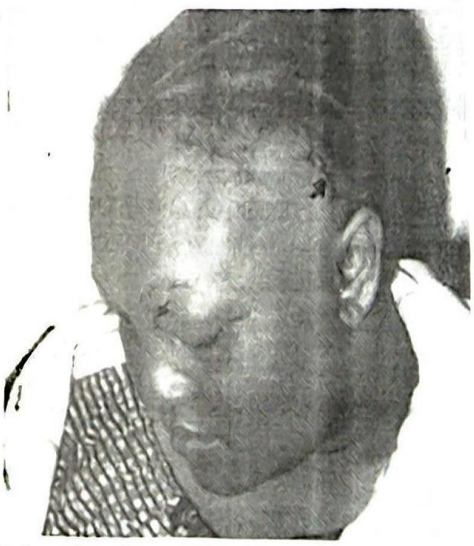

Fig. 2: Frontolateral view of the face of the patient showing the temporal and eyebrow incision wounds and the absense of reservoir sign

Discussion

Delayed CSF leak after 48 hours as found here is unusual for traumatic CSF fistula [2]. Possible explanations include:

1. slow herniation of an intact dura through a bony defect which finally tear it.
2. A tear and bony defect which were present at the time of the original injury with the leak presenting only after the dissolution of a masking hematoma [1,2,7]

Although there were no associated clinical complications in this patient, meningitis and pneumocephalus have been reported in 30% of cases [4,6]. The diagnosis here was based on clinical and radiological assessment. CT Scan showed the defect in the lower posterior wall of the frontal sinus extending to the posterior ethmoid. The sphenoid appeared intact. We assumed that this is the site of leakage although the presentation of the patient did not appear classical of a leak from the frontoethmoid region. In a series of 53 patients with CSF rhinorrhea, fistula in the region of the cribriform plate and air cells of the ethmoid sinus accounted for 39%; frontal sinus 15% of leaks, and in another 15%, the leak was in the area of the sella turcica and sphenoid sinus [4-6].

The indication for surgical closure in this case is prolonged leakage of CSF. Other indications for closure include: patients with large high-volume fistulas, nontraumatic leaks and open wounds that are connected to the dural defect, closed head injuries with intracranial complications and fistulas caused by and detected at operation [6,7].

We found high resolution CT Scan and plain radiograph of the brain and sinuses useful in confirming the site of leakage in this case because these were the only investigative modalities available in this region of the country. It has an added advantage of assessing the brain parenchyma thus obviating the need for intracranial approach. Contrast CT cisternography which has been reported as the investigation of choice could not be done due to non-availability. The other modalities that can further enhance diagnosis are MRI and nuclear studies [1,2]. Various dyes like methylene blue, phenolsulfonphthalein, indigo carmine, and fluorescein have been used to demonstrate the osculum of the fistula [8,9]. Fluorescein is still in use but is not preferred because it is associated with complications like transverse myelitis and allergic reactions [9]. The Valsalva maneuver has also been used to detect ambiguous sites of leakage in CSF rhinorrhea.

The choice of trans-frontal approach in this case affords good access and also avoids the morbidity and mortality associated with intracranial approach. The graft material used was deep temporalis fascia graft since we often use this for most skull base repairs in our unit. It also has the advantage of proximity to the operation site. Among the other materials that have been reported are fascial lata, perichondrium of tragal and conchal cartilage and muscle flaps [2,3,4]. However, free grafts are less bulky and are thought to interfere less with postoperative nasal function [9]. We used surgicele to secure the graft, while fibrin glue has been used by other workers [10,11].

Exposure of the skull base and the necessity of brain retraction during intracranial procedures are associated with a significant risk of anosmia, postoperative intracerebral hemorrhage, and brain edema [12]. The failure rate associated with the management of CSF leaks via an intracranial approach has ranged from 20 to 40% [12,13]. The short stay of this patient in the hospital after surgery has also confirmed this advantage of extracranial approach over the intracranial route.

CSF fistula has been managed predominantly by neurosurgeons in most parts of developing countries like Nigeria. Certainly, more patients will benefit from the type of management reported in this case where the otorhinolaryngologist is also proficient. However, this may require further training in skull base techniques.

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