ANALYTICAL STUDY OF SURGICAL MANAGEMENT OF ARACHNOID CYSTS

DISSERTATION SUBMITTED FOR

MASTER OF CHIRURGIE

BRANCH - II - NEURO SURGERY – 3YEARS

THE TAMILNADU
DR.M.G.R. MEDICAL UNIVERSITY
CHENNAI, TAMILNADU

AUGUST 2011

ANALYTICAL STUDY OF SURGICAL MANAGEMENT OF ARACHNOID CYSTS

DISSERTATION SUBMITTED TO

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE

MASTER OF CHIRURGIE

BRANCH - II - NEURO SURGERY – 3YEARS

AUGUST 2011

MADURAI MEDICAL COLLEGE
MADURAI

THE TAMILNADU
DR.M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

CERTIFICATE

This is to certify that this dissertation titled **"ANALYTICAL STUDY OF SURGICAL MANAGEMENT OF ARACHNOID CYSTS**" submitted by **DR. S. BALAMURUGAN** to the faculty of Neuro Surgery, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement in the award of degree of **MASTER OF CHIRURGIE IN NEURO SURGERY,** for the **August 2011** examination is a bonafide research work carried out by him under our direct supervision and guidance.

THE DEAN

Madurai Medical College,
Madurai

PROF. N.ASOKKUMAR, M.Ch.,

Professor and Head of the Department
Department of Neuro Surgery,
Madurai Medical College,
Madurai.

DECLARATION

I, **Dr. S. BALAMURUGAN** solemnly declare that this dissertation **"ANALYTICAL STUDY OF SURGICAL MANAGEMENT OF ARACHNOID CYSTS"** were prepared by me under the guidance of supervision of Professor and HOD, Department of Neurosurgery, Madurai Medical College and Government Rajaji Hospital, Madurai between **2008 and 2011.**

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of **MASTER OF CHIRURGIE, in NEURO SURGERY,** degree Examination to be held in **AUGUST 2011.**

Place : Madurai

Date : **Dr. S. BALAMURUGAN**

ACKNOWLEDGEMENT

I thank with gratitude, THE DEAN, Madurai Medical College, Madurai for permitting me to utilize the clinical materials of this hospital.

I am gratefully indebted to Prof. Dr. N. Ashok Kumar, M.Ch., Head of the Department, Department of Neuro Surgery for the valuable guidance, advice and inspiration rendered in this study.

I acknowledge the guidance and support given by Prof. Dr. N. Muthukumar, M.Ch., to complete the study successfully.

I acknowledge the guidance and help given by Prof. Dr. R. Veerapandiyan, M.Ch., during this study.

I wish to express my sincere thanks to Prof. Dr.S. Manoharan, M.Ch., and Prof. Dr. D. Kailairajan, M.Ch., for their guidance and help during this study.

I am thankful to all Assistant Professor of my department for their encouragement and guidance to complete the study.

Finally, I would like to extend my heartfelt appreciation to my parents and wife who assisted me in every way in preparing their study.

CONTENTS

INTRODUCTION

Arachnoid cysts are benign developmental cysts that occur in the cerebrospinal axis, in relation to the arachnoid membrane. They are relatively common benign lesions of the arachnoid, with a reported prevalence as high as 1.1% in the adult population. Most of these lesions become symptomatic in early childhood. Hence, 60 to 90% of all patients with arachnoid cysts are children.[1]

All intracranial arachnoid cysts are located entirely intradurally, with exception of intrasellar and intradiploic arachnoid cysts, whereas spinal arachnoid cysts are located extradurally.

Arachnoid cysts occur between layers of the arachnoid membrane that may become symptomatic via mass effect on surrounding structures, spontaneous rupture or hemorrhage, or obstruction of CSF outflow pathways. The cysts contain clear, colourless fluid resembling normal cerebrospinal fluid. They do not communicate with the ventricular system.

There has been significant debate about the origin as well as the optimal surgical management of arachnoid cysts. The optimal treatment for lesions requiring surgical intervention, such as those causing symptoms or expanding (determined by sequential imaging), remains to be determined. Many have favoured initial cyst fenestration, usually into the basal cisterns. Others have advocated the placement of cystoperitoneal shunts as a primary treatment for these cysts.

AIM OF STUDY

The aim of the study is

1. To analyse the clinical presentation of arachnoid cysts in patients coming to neurosurgical department in Government Rajaji Hospital and Madurai Medical College.
2. To analyse the distribution of arachnoid cysts in different locations of cranio-spinal axis.
3. To analyse the various surgical procedures underwent by the patients with arachnoid cysts in our hospital.
4. To compare the surgical outcome in patients on follow-up.

MATERIALS AND METHODS

This study was conducted at Government Rajaji Hospital and Madurai Medical College Hospital.

The patients included in this study were having one of the following

1. Intracranial arachnoid cyst.

2. Spinal arachnoid cyst.

These patients were seen in neurosurgical outpatient department , admitted and undergone surgery . Patients who were initially operated for arachnoid cyst and were on regular followup in neurosurgical outpatient department were also included in the study.

Thirty five patients were included in the study including nine males, seventeen females, four male children and five female children over a period of thirty three months from August 2008 to March 2011. All patients were preoperatively evaluated with computer tomography scan and magnetic resonance scan.

Clinical presentation of all patients were noted. Postoperatively regression of symptoms or persistence or appearance of any new symptoms were analysed. Patients with intracranial arachnoid cysts were subjected to different surgical procedures like craniotomy and cyst

excision, fenestration to the basal cistern, cystoperitoneal shunt, ventriculoperitoneal shunt, and endoscopic fenestration. Patients with spinal arachnoid cysts were subjected to laminectomy or laminotomy and cyst excision.

Postoperative imaging of patients were done. Surgical outcome of patients were analysed with clinical improvement of symptoms and with radiological regression of the arachnoid cysts. Complications following surgery and need of second surgery were noted.

REVIEW OF LITERATURE

HISTORY :

Bright was the first to describe arachnoid cyst [1] under the title "Serous Cysts in the Arachnoid" in 1831. In 1958, Starkman concluded from study of autopsy specimens that arachnoid cysts evolve from a developmental aberration characterized by splitting and duplication of the arachnoid membrane and that they are truly intra-arachnoid in location.

INCIDENCE :

Arachnoid cysts are developmental in nature. Trauma or infection doesnot play any role in causation of arachnoid cysts that occur in relation to intracranial subarachnoid cisterns.

Arachnoid cysts correspond to about 1% of all intracranial lesions in the general population and about 3% in the pediatric population. Although 60-90% of reported cases have been found in young people, in less than 20 years old, it is possible to find them in the elderly.

Data from autopsy studies have shown a low incidence ranging from 0.l to 0.7%, a rate that correlates with that in studies of cranial magnetic resonance images, which show an incidence of 0.75%. Most cysts are incidentally diagnosed during neuroimaging after head trauma. Prenatal ultrasonography as well as increased access to computed tomography and

magnetic resonance imaging has allowed cyst detection at earlier ages. Hence, most cysts are recognized during the first two decades of life.

The sex distribution shows a preference for the males, in the ratio of 3:1 and for left side of the central nervous system structures.

Multiple or bilateral arachnoid cysts are unusual, and familial occurrence has been reported in only a few cases. An association between bilateral sylvian fissure arachnoid cysts and Glutaric aciduria Type 1 has been demonstrated. [1]

Arachnoid cysts are classified according to their relation to the subarachnoid space as

1. Communicating and
2. Noncommunicating.

Inadequate or non-existent communication between the cyst and the subarachnoid space seems to be responsible for the mass effect and progressive symptoms. Computed tomographic cisternography is the most widely used diagnostic method to show the communication between the cyst and the subarachnoid space. Differentiation of communicating cysts and noncommunicating ones is often required if surgical therapy is contemplated.

Older terminologies include leptomeningeal cyst, subarachnoid cyst, intraarachnoid cyst, arachnoidocele, arachnoid pouch, arachnoid diverticulum, internal meningocele.

EMBRYOLOGY :

In the early embryo, a loose layer of mesenchymal tissue surrounds the neural tube, called the perimedullary mesh or endomeninx. Perimedullary mesh is thought to be the precursor of the pia mater and arachnoid mater. With the rupture of the rhombic roof, cerebrospinal fluid seeps within the layers of perimedullary mesh, being propelled by the pulsatile force of the choroid plexus. It is the flow of the cerebrospinal fluid that determines the differentiation of the perimedullary mesh into a superficial layer, the arachnoid mater, and a deeper layer,the pia mater, with the subarachnoid space in between. It is postulated that arachnoid cysts develop because of a minor aberration in the flow of cerebrospinal fluid in the primordial stage of the development of subarachnoid pathways, resulting in the sequestration of an enclosed chamber or diverticulum within the premedullary mesh.

The mechanisms underlying the formation and filling of arachnoid cysts are not well understood, but clinical, epidemiological, and laboratory

data indicate that genetic mechanisms are involved in the *formation* of arachnoid cysts.

There are four proposed theories regarding the cause of these cysts:

1. A ball-valve mechanism - that is, a possible anatomical communication between the cyst and the subarachnoid space that can act as a one-way valve mechanism responsible for cyst enlargement .
2. An osmotic gradient between the intra and extracystic medium responsible for a gradient driven fluid transport - this theory lacks support given the great compositional similarity between cerebrospinal fluid and the cyst's fluid content.
3. A malformation leading to trapped fluid content in cerebral lobe agenesis and
4. Hypersecretive fluid production by cells lining the luminal cyst's wall.

One-way pulsatile movement of cerebrospinal has been demonstrated by cine-mode magnetic resonance imaging studies [2] and confirmed at endoscopic operations by inspecting the inside of the cyst wall. Ultrastructurally, the cyst lining cells demonstrate the presence of microvilli on the luminal surface and cytoplasmic vesicles that are consistent with fluid secretion. Moreover, enzyme immunocytochemistry

demonstrated Na-K adenosine triphosphatase in the plasma membranes lining the cavity at the luminal side and near the intercellular clefts at the basolateral side, a structural organization consistent with fluid transport toward the lumen.The argument against continuous secretion lay in the fact that cysts often remain static in size and sometimes disappear, [3] thus demonstrating that secretion is neither universal nor likely the only mechanism involved. R. Seizeur et al [3] has given an account of spontaneous resolution of arachnoid cysts and reviewed the features of an unusual case. Schuhmann and colleagues have described choroid plexus ectopia inside a growing arachnoid cyst.

Luca Basaldella et al [4] attempt to add new insights into the pathogenesis of arachnoid cysts by considering aquaporin expression in the cyst wall. Aquaporins act as putative water channels that have offered new insights into the water balance preservation of many anatomical regions in humans, in animals, and in plants and other microorganisms. In the central nervous system mainly three Aquaporins have been identified

1. AQP1 in the choroid plexus.
2. AQP4 in the astrocytic end-feet of the blood–brain barrier and
3. AQP9, which was first described in tanycytes and glucose-sensitive neurons.

Berle M et al [5] studied the arachnoid cyst fluid by clinical chemistry and compared arachnoid cyst fluid to cerebrospinal fluid drawn from the same patient. Arachnoid cyst fluid and cerebrospinal fluid had the same osmolarity. There were no significant differences in the concentrations of sodium, potassium, chloride, calcium, magnesium or glucose. They found significant elevated concentration of phosphate in arachnoid cyst fluid and significantly reduced concentrations of total protein, of ferritin and of lactate dehydrogenase in arachnoid cyst fluid relative to cerebrospinal fluid.

PATHOLOGY:

An arachnoid cyst is by definition, a benign lesion, with well defined outline, within the arachnoid membrane or covered by layers of arachnoid cells supported by collagen fibres, having liquid contents similar to cerebrospinal fluid. It is a cavity, whose walls are formed by arachnoid cells which can be simple or multiple layers, supported by a stroma, rich in collagen fibres.

The structural features of the arachnoid cyst wall that distinguish it from the normal arachnoid membrane are

1. Splitting of the arachnoid membrane at the margin of the cyst.
2. Thick layer of collagen in the cyst wall.

3. Absence of traversing trabecular processes within the cyst and
4. Presence of hyperplastic arachnoid cells in the cyst wall, which presumably participate in collagen synthesis.

When surgical tissue specimen are examined, which contains the dome of the arachnoid cyst, it resembles histologically the normal arachnoid membrane. It consists of laminated collagen bundles, clusters of mesothelial cells lining the surface. In an autopsy specimen, the most significant autopsy finding is the splitting of the arachnoid membrane at the margin of the cyst. The cyst is truly intraarachnoidal, contained between the outer and inner layers of the arachnoid. The cyst cavity is clear, devoid of proteinaceous or inflammatory cells or hemosiderin granules.

ANATOMICAL DISTRIBUTION :

Arachnoid cysts are most common in sylvian fissure [6] . Other sites include cerebellopontine angle, supracollicular area, vermis, sellar and suprasellar areas. Least common areas are clival-interpeduncular area, intraventricular and intradiploic spaces. Owing to the widespread use of magnetic resonance imaging and computer tomography scan, the posterior fossa arachnoid cysts are now being detected far more often than cysts in other locations.

CLINICAL FEATURES:

In many instances, an arachnoid cyst is an incidental finding. The clinical presentation will depend on the location and size of the arachnoid cyst, and the symptoms often are mild considering the large size of some cysts [7, 8]. Most patients will come to medical attention in the first two decades of life, often in the first 6 months.

These lesions cause symptoms and signs of increased intracranial pressure by compressing the normal tissue and obstructing the cerebrospinal fluid pathway. The symptoms depend on the cyst localization. Symptoms and signs include cranial enlargement, localized cranial bulging, especially the large cysts, can present acutely with sudden deterioration [9, 10].

Ganesh Rao et al [11] describe two cases of rapidly enlarging arachnoid cysts, including one located in the anterior fossa.

Suprasellar cysts may also present with endocrine symptoms, head bobbing, and visual disturbances. Either communicating or obstructive hydrocephalus is often present. In the elderly, dementia has been described.

Intraspinal cysts may produce a tetraparesis or paraparesis, with abnormal reflexes, sphincter dysfunction, sensibility alterations and radicular pain according to the level of the lesion.

RADIOLOGICAL EVALUATION :

Plain radiographic findings are nonspecific and have little to offer in the diagnosis of arachnoid cysts, although changes in skull contour may be detected on skull radiographs performed for other indications, such as trauma. Forward bowing of the anterior cranial wall of the middle cranial fossa and elevation of the sphenoidal ridge have been reported findings on skull radiographs of patients with arachnoid cysts of the middle cranial fossa. In infants, craniomegaly associated with widening of the fontanelle and thinning of the calvarium may be observed. The spinal canal may be widened, and erosion of the pedicles may occur.

Intracranial arachnoid cysts may be an incidental finding on computer tomogram scans. Typically, in cases of arachnoid cysts, the subarachnoid space is compressed by a cystic structure that may be unilocular or septate. On computer tomography, arachnoid cysts appear as low-density, smooth-bordered lesions having attenuation values similar to that of CSF. The cyst wall has well-defined margins and doesnot enhance after intravenous injection of a contrast agent. It is a noncalcified extraparenchymal cystic mass. CT attenuation values and signal intensities of arachnoid cysts parallel those of cerebrospinal fluid. CT may also show bony remodeling.

The differential diagnosis of low-attenuation lesions on CT similar to arachnoid cysts includes hemorrhagic or nonhemorrhagic cysts associated with tumors, ependymal cysts, dermoid or epidermoid cysts, cystic astrocytomas, and lipomas.

Magnetic resonance imaging is the diagnostic procedure of choice because of its ability to demonstrate the exact location, extent, and relationship of the arachnoid cyst to adjacent brain or spinal cord. On MRI, arachnoid cysts typically appear as extra-axial cysts with no internal architecture. The cyst wall does not enhance with contrast administration and the cyst contents have the same signal intensity as cerebrospinal fluid on all imaging sequences. On MRI, arachnoid cysts appear as well-defined nonenhancing intracranial masses that are isointense to cerebrospinal fluid.

The most important differentiation to make is between arachnoid cysts and epidermoid cysts. MRI diffusion-weighted images make differentiating the two masses easier. Some arachnoid cysts contain proteinaceous fluid or blood. In such cases, signal loss on diffusion-weighted images may not be marked, which may pose diagnostic problems. Also, tissue contrast with fluid-attenuated inversion recovery imaging is similar to that with a T2-weighted image, but FLAIR shows no signal arising from the cerebrospinal fluid. Thus, unlike with epidermoid

cysts, arachnoid cysts containing cerebrospinal fluid demonstrate a suppressed or low signal on FLAIR.

Arachnoid cysts are more homogeneous, whereas in epidermoid cysts the signal within the lesion is more heterogenous. On diffusion weighted imaging, arachnoid cysts are lower in signal because of the presence of a large number of mobile protons, whereas epidermoids are higher in signal intensity. On steady-state free-precession MRI, arachnoid cysts remain homogenous, whereas epidermoid tumour signal heterogeneity is accentuated.

MRI may show the arachnoid membrane and also differentiates the cerebrospinal fluid in the arachnoid cysts from the neoplastic cysts and ependymal which is usually, intraparenchymal cysts. Porencephalic cyst usually communicate into the ventricle. In addition associated cerebral and cerebellar hypoplasias are well studied.

The demonstration of communication between arachnoid cysts and the adjacent subarachnoid space is a prerequisite for their proper management. CT cisternography is the conventional method for functional evaluation of arachnoid cysts. However, the major disadvantages of CT cisternography are its invasiveness, considerable amount of x-ray exposure, long imaging time, and cost. The sensitivity of MR imaging to cerebrospinal fluid flow has been demonstrated, but reports of the clinical

usefulness of MR cerebrospinal fluid flow techniques in this application are limited.

Harun Yildiz et al [12] has performed MR cerebrospinal fluid flow study with retrospective ECG-gated 2D, fast low-angle shot, phase-contrast, cine gradient-echo sequence in thirty nine patients with an intracranial arachnoid cysts. Results were compared with intraoperative and CT cisternography findings. Phase contrast cine MR imaging results were compatible with operative or CT cisternography findings in thirty six (92.3%) of thirty nine patients. Twenty-four cysts were noncommunicating and fifteen were communicating. He concludes that MR cerebrospinal fluid flow imaging with a Phase contrast cine sequence can be incorporated in the imaging work-up of archnoid cysts. This is a reliable alternative to invasive CT cisternography for the functional evaluation of arachnoid cysts.

In a study by Algin et al, the sensitivity and specificity of phase-contrast cine magnetic resonance imaging in identifying communications between intraventricular arachnoid cysts and the cerebrospinal fluid were found to be 100% and 54%, respectively.

MRI of spinal arachnoid cysts demonstrates an oval, sharply demarcated extramedullary mass that may cause local displacement and / or spinal cord compression. The cyst is usually hyperintense to

cerebrospinal fluid on T2-weighted sequences because of the relative lack of cerebrospinal fluid pulsation artifacts.

Myelography and computed tomography myelography remain of diagnostic value, especially for cases that are not definitive on MRI.

Cranial ultrasonography is an important diagnostic tool during the first year of life. Although symptomatic arachnoid cysts are comparatively rare in infants, ultrasound is useful as a noninvasive imaging technique with high yield in the detection and characterization of cystic masses.

PRESENTATION OF ARACHNOID CYST IN DIFFERENT LOCATIONS :

The clinical symptoms and signs of arachnoid cysts depends on the location of the cyst. The presentation of the individual intracranial and spinal arachnoid cysts are described in detail below.

SYLVIAN FISSURE OR MIDDLE CRANIAL FOSSA ARACHNOID CYSTS :

The sylvian fissure is the most common site for arachnoid cysts [13, 14]. It represents about 50% of adult cases and 30% of pediatric cases. It can manifest clinically at any age, more during infancy and adolescence. Males predominate and the left hemisphere is more commonly involved. It can be

asymptomatic throughout life. When symptomatic, headache is the most common symptom followed by seizures. X-ray of skull and Computed tomograms show expansion of the middle cranial fossa.

GALASSI has classified the middle cranial fossa arachnoid cysts based on CT appearance into three types.

TYPE 1 :

- A small lenticular lesion at the anterior pole of the middle cranial fossa.
- It has no mass effect nor displacement of midline structures.
- Cisternography shows free communication between the cyst and the subarachnoid space.

TYPE 2 :

- A quadrangular shaped cyst involving the proximal and intermediate segments of sylvian fissure.
- Expansion of middle fossa present. No or minimal midline displacement.
- Cisternography shows partial communication between the cyst and the subarachnoid space.

TYPE 3 :

- A large smooth rounded cyst involving the entire sylvian fissure.
- Bony expansion of middle cranial fossa present.
- Significant midline displacement present.
- Cisternography shows no communication between the cyst and the subarachnoid space.

All arachnoid cysts that cause a mass effect or neurological symptoms should be treated surgically. Decompression of the cysts, especially in children, lead to decreased parenchymal compression, cyst collapse, and subsequent resolution of intracranial hypertension and neurological deficits. The optimum surgical management of symptomatic sylvian fissure cysts is not clear.

Cyst fenestration and excision appears to be the best initial treatment for symptomatic sylvian fissure cysts. The advantage of excision of the outer cyst wall and fenestration of the inner wall is that it is more definite, the cyst can be directly visualized, any bridging veins can be coagulated and the procedure doesnot leave an implanted foreign body.

Ventriculocystoperitoneal or cystoperitoneal shunting is also widely used in the initial treatment for middle fossa arachnoid cysts. In

hydrocephalic children, cyst fenestration may not resolve ventriculomegaly or intracranial hypertension. Nonhydrocephalic patients who are initially treated with cyst fenestration have higher rate of cyst recurrence and eventually require cystoperitoneal shunt.

Though the shunting procedure is simpler than fenestration, the cyst cavity is not adequately visualized [15, 16], bridging veins cannot be coagulated. Infection, shunt occlusion, cyst recurrence, slit-ventricle syndrome, slit cyst syndrome are risks involved in shunting.

ARACHNOID CYSTS IN SELLA TURCICA :

Arachnoid cysts occurring in sella turcica are divided into

1. Suprasellar cysts : Those occurring above the diaphragm sellae.
2. Intrasellar cysts : Those that occur within the sella.

Suprasellar cysts are more common, mostly occurring in children. It may present as hydrocephalus, visual impairment, and endocrine dysfunction [17]. The " bobble-head doll syndrome" is also noted, which consists of irregular involuntary head motions in the anteroposterior direction occurring two to three times per second , when the child is erect and absent during sleep.

On imaging, a large oval or round lucency in the region of the third ventricle which is hypodense on CT is found. On MRI, the lesion is hypointense in T1 weighted image and hyperintense in T2 weighted image identical to the cerebrospinal fluid is seen. Similar features are seen in dilated third ventricle caused by aqueductal stenosis, craniopharyngioma, epidermoid cyst, cystic glioma.

The commonly used methods of treating suprasellar arachnoid cysts are endoscopic ventriculocystostomy [18], subfrontal cyst excision with communication to the basal cisterns, and transcallosal or transventricular cyst excision with concomitant cystoperitoneal shunting.

Intrasellar arachnoid cysts are unique in that they have never been observed in infancy. They are the cranial arachnoid cysts that occur extradurally, the only other being intradiploic cysts. They are not associated with subarachnoid cistern, though a pinhole communication between the cyst and the suprasellar subarachnoid space.

Intrasellar arachnoid cysts present with headache. Other presentation may be hypothyroidism and adrenal hypofunction, decreased visual acquity, bitemporal hemianopic field cuts and optic atrophy. Imaging may show ballooned sella turcica and cystic nonenhancing, discrete lesion

confined to the sella. The normal pituitary and the pituitary stalk are compressed and displaced posteriorly. It is removed trans-sphenoidally.

YR Yadav et al [18] have reported their experience with endoscopic management in twelve patients with suprasellar arachnoid cyst. The endoscopic procedure included lateral ventricle puncture by precoronal burr hole and superior and inferior wall of the cyst was communicated with the lateral ventricle and the interpeduncular cistern respectively. They conclude that endoscopic fenestration is a minimally invasive technique, which is a safe and effective alternative treatment for suprasellar arachnoid cyst.

INTERHEMISPHERIC FISSURE ARACHNOID CYSTS :

Arachnoid cysts are uncommon in interhemispheric fissure. It is often associated with partial or complete agenesis of the corpus callosum. Two morphologic types of arachnoid cyst occur near the midline in the supratentorial space.

1. Interhemispheric cysts :

- It is associated with partial or complete agenesis of the corpus callosum.

- It occurs in midline, straddling falx, extending equally on either side.

- Coronal CT or MRI shows " bat wing" appearance of the lateral horns and dorsal displacement of the third ventricle.

2. Parasagittal cysts :

- It is not associated with agenesis of the corpus callosum.

- It is strictly unilateral and limited by falx.

- It is wedge-shaped.

Interhemispheric arachnoid cysts can distort the cerebrospinal fluid pathways, leading to ventricular enlargement that is often asymmetrical. They are usually very large when discovered, but they generally cause mild clinical symptoms. Although these cysts can be incidentally discovered prenatally, they are usually found in association with clinical symptoms such as macrocrania, headaches, epileptic seizures, and psychomotor retardation.

Giuseppe Cinalli et al [19] reported seven consecutive pediatric patients with interhemispheric arachnoid cysts who underwent neuroendoscopic treatment involving cystoventriculostomy in two patients, cystocisternostomy in two, and cystoventriculocisternostomy in three .

Placement of shunts, microsurgical marsupialization of the cyst and endoscopic methods to create areas of communication between the cyst, the ventricular system, and/or the subarachnoid space are the treatment options available.

Cavum Vergae is situated over the anterior part of the third ventricular floor and Cavum Veli interpositi is located posteriorly to cavum vergae possibly extending as far as quadrigeminal plate. Cushing proposed the name 5th cerebral ventricle to persisting cavum septi pellucidi and cavum vergae and 6th ventricle to cavum veli interpositi.

CEREBRAL CONVEXITY ARACHNOID CYSTS :

In infants, the lesion is characterized by progressive but asymmetric enlargement of the head. Bilateral cysts simulate hydrocephalus or hydranencephaly.MRI appearance mimic a subdural hygroma, but an enhancing membrane is lacking. In adults, it may present with focal or grand mal seizures, headaches, papilledema and progressive contralateral hemiparesis. Skull Xray show erosion of inner table of skull. Surgical therapy consists of excision of the outer membrane of the cyst.

QUADRIGEMINAL CISTERN ARACHNOID CYSTS:

Arachnoid cysts in this region behave like pineal masses and commonly present as obstructive hydrocephalus. Children present with progressive enlargement of head and adults with increased intracranial pressure. Pupillary reactivity or eye movements are disturbed due to compression of the quadrigeminal plate or stretching of the 4th nerve.Resection of the cyst wall through an occipital transtentorial approach with or without insertion of a cystoperitoneal shunt is the treatment of choice.

CLIVAL REGION ARACHNOID CYSTS:

It is an uncommon site for intracranial arachnoid cysts, but may extend into interpeduncular cistern or cerebellopontine angle. The cysts displaces the midbrain and pons dorsally with the basilar artery. Surgical therapy involves exposure of the cyst through a presigmoid approach, with wide excision of the cyst wall.

CEREBELLOPONTINE ANGLE ARACHNOID CYSTS:

Arachnoid cyst in this location mimic acoustic neuroma. It may present with sensorineural hearing loss, impaired corneal reflex, cerebellar signs and increased intracranial pressure. Imaging shows a cystic lesion in

the cerebellopontine angle, that may extend to the prepontine area and inferiorly to the jugular foramen. Treatment consists of suboccipital craniectomy and wide excision of the cyst wall.

POSTERIOR FOSSA ARACHNOID CYSTS:

Arachnoid cyst can be found in the midline area near the fourth ventricle or cistern magna or the paramedian area opposite the cerebellar hemisphere [20]. It presents with obstructive hydrocephalus and increased intracranial pressure. Imaging with CT will show a smooth, rounded, nonenhancing, low density lesion in the region of the fourth ventricle or the cisterna magna. Midline arachnoid cysts of the posterior fossa have to be differentiated from mega cisterna magna, Dandy-Walker syndrome, epidermoid cyst,cystic astrocytoma and cystic hemangioblastoma.

Posterior fossa arachnoid cyst results in displacement of the fourth ventricle, but normal cerebellar development. Dandy-Walker malformation is a cystic dilatation of the fourth ventricle or a cyst in communication with 4th ventricle. Mega cisterna magna is an anatomic variant with normal fourth ventricle and small cerebellum. Surgical therapy consists of a midline posterior fossa craniectomy and wide excision of the outer cyst wall.

INTRAVENTRICULAR ARACHNOID CYSTS :

Intraventricular arachnoid cysts are classified into

1. **Primary** : those that arise in lateral or fourth ventricle
2. **Secondary :** originate extra-axially and encroach into the ventricles

They originate from arachnoid that invaginates through the choroid fissure into the choroid plexus. They appear as cerebrospinal fluid-filled, thin-walled lesions in the atrium of the ventricle. The differential diagnosis includes ependymal cyst, epidermoid cyst, dermoid cyst, infectious cyst, and porencephalic cyst. Asymptomatic cavum septi pellucid and septum cavum veli interpositi may be considered normal variants. Fenestration of the cyst , either endoscopically or open surgery is done.

DIPLOIC SPACE ARACHNOID CYSTS :

It is a rare location presenting as lytic lesion of the skull in middle aged to older men. It is due to congenital diverticuli of the arachnoid membrane through small defects in the dura mater. The differential diagnosis includes dermoid and epidermoid cyst, hemangioma, eosinophilic granuloma, plasmacytoma and metastatic tumour. Treatment consists of excision of the cyst wall, packing of the dural and bone defects with gelfoam and watertight closure of the scalp.

SPINAL ARACHNOID CYSTS :

Arachnoid cysts also occur within the spinal canal, either located subdurally or in the epidural space. They are rarer than intracranial cysts. Spinal arachnoid cysts are commonly located dorsal to the cord in the thoracic region. A cyst in this location is usually secondary to a congenital or acquired defect and is situated in an extradural location. Intradural spinal arachnoid cysts are secondary to a congenital deficiency within the arachnoidal trabecula, especially in the septum posticum or are the result of adhesions resulting from previous infection or trauma. Extramedullary location is common.

Microscopic examination shows that their walls are formed from a splitting of the arachnoid membrane, with an inner and outer leaflet surrounding the cyst cavity.

They cause symptoms indistinguishable from cord compression due to other causes. Patients with spinal arachnoid cysts may become symptomatic as a result of local cord displacement or cord compression. Epidural arachnoid cysts often are associated with kyphoscoliosis in juveniles. Arachnoid cysts are also associated with myelodysplasia in spinal dysraphic lesions. Pain produced by intraspinal arachnoid cysts typically is aggravated by the valsalva maneuver, which increases pressure within the cyst.

Remission of symptoms is not uncommon. Surgical excision is curative. Various classification systems are there for spinal arachnoid cysts. The most commonly used current classification system are

Goyal, et al., 1987 :

1. Perineurial cyst/Tarlov cyst : Cyst formation within nerve root sheet at Dorsal root ganglia

2. Root sleeve dilation : Enlargement of subarachnoid space around nerve root proximal to Dorsal root ganglia

3. Intradural arachnoid cyst : Arachnoid pockets within thecal sac

4. Extradural arachnoid cyst : Arachnoid outpouching through dural defect

5. Traumatic root cyst : Traumatic tear in leptomeninges causing cerebrospinal fluid collection

Nabors, et al., 1988 :

Type I : Extradural meningeal cyst without nerve root fibers.

Type II : Tarlov cyst - extradural meningeal cyst with nerve fibers

Type III : Intradural spinal meningeal cyst.

SPINAL EXTRADURAL ARACHNOID CYSTS :

Extradural arachnoid cysts develop from protrusions of arachnoid herniating through a small dural defect. The cysts have a pedicle in communication with the spinal subarachnoid space and because of their origin, contain cerebrospinal fluid.

Spinal extradural arachnoid cysts are a rare cause of spinal cord compression. These cysts most commonly occur in the middle to lower thoracic spine (65%) but also have been reported in the lumbar and lumbosacral (13%), thoracolumbar (12%), sacral (7%), and cervical regions (3%). Thoracic cysts usually occur in young adolescents, whereas thoracolumbar and lumbar cysts usually appear in adults in the fourth decade of life.

These lesions often arise dorsally and can partially protrude into the adjacent neural foramen. A single cyst can extend over several spinal segments or multiple cysts with separate dural defects and communicating pedicles can compose one lesion. They are usually found posterior to the spinal cord but have been described in the posterolateral and anterior positions as well. Cyst enlargement can result in symptomatic spinal cord compression.

Muthukumar N [21] in European Spine Journal 2002 gave a report on a 25-year-old man with a sacral extradural arachnoid cyst causing low back

and perineal pain. He underwent sacral laminectomy with opening of the arachnoid cyst and ligation of the fistulous tract and there was complete clinical recovery postoperatively. He stressed that this entity should be considered in the differential diagnosis of low back and perineal pain, and that surgical treatment was curative.

J. Y. Choi et al [22] in their illustrated review of spinal extradural arachnoid cyst, also state that surgical treatment is curative and a dural defect or stalk cannot always be found during surgery. Kulkarni et al. reported that the site of communication of the cyst contents with subarachnoid CSF could not be found during the surgery in their series.

SPINAL INTRADURAL ARACHNOID CYSTS :

Spinal intradural arachnoid cysts are considered to be rare entities and are less common than extradural arachnoid cysts. Sato et al suggested that spinal intradural cysts are uncommon and rare cause of neural compression. Among the spinal intradural arachnoid cysts, posterior cysts are more common than anterior cysts.

Other intradural cystc lesions include neuroenteric cysts, epidermoid and dermoid cysts, developmental arachnoid diverticula and cysts.

The commonest site is thoracic in about 80 %, followed by cervical in 15 % and lumbar in 5 %. The various causes put forth for its

development are congenital, arachnoiditis - due to infective agents, subarachnoid hemorrhage, contrast, spinal anaesthetics,meningitis, fibrin glue, bone dust, trauma, lumbar puncture,intradural spinal surgery and idiopathic.

The various theories were postulated for the formation of spinal intradural arachnoid cysts. Perret et al postulates its origin from the septum posticum of schwalbe . Teng & Rudner felt that it was due to normal variations of intraspinal cerebrospinal fluid pressure. Fortuna et al found that ther was hypertrophy, proliferation & dilatation of arachnoid granulations in patients with spinal intradural arachnoid cysts.

The presentation depends on cyst location. It causes local compression of spinal tracts and the development of symptoms is usually slow.

Muthukumar N [23] has described two cases of cervical intradural anterior arachnoid cysts presenting as traumatic quadriplegia in Child's Nervous System vol 20, number 10, oct 2004.

IMAGING IN SPINAL ARACHNOID CYSTS :

Plain x-ray films have not proved useful in the diagnosis of arachnoid cyst . Only indirect signs attributable to the mass effect of large cysts such as an enlarged spinal canal, bony erosions of the spine, slender pedicles, widened foramina or an increased interpedicular distance can be visualized

Magnetic resonance imaging had great sensitivity to and specificity for extradural arachnoid cyst and seemed to be the diagnostic procedure of choice. With all sequences, the signal within the lesion is iso-intense to cerebrospinal fluid.

Recently, kinematic MRI studies have been performed to define the physiological or pathological changes that occur in the subarachnoid space. Doita et al. reported on the use of kinematic MRI to clarify the pathomechanism of fluctuating symptoms caused by an extradural arachnoid cyst during straining. They concluded that the pressure changes that occurred in the extradural space as well as in the arachnoid cyst might cause spinal cord compression, and this should be considered as an alternative explanation for intermittent exacerbation of symptoms in patients with extradural arachnoid cyst. Nakagawa et al reported on the usefulness of constructive interference in steady state –CISS imaging for the diagnosis and treatment of a large extradural spinal arachnoid cyst.

They used 3D constructive interference in steady state -CISS MRI to clearly demonstrate the pedicle of the cyst.

The most common presenting symptoms and signs are pain and progressive spastic or flaccid paraparesis, which are often asymmetrical. The symptoms are fluctuating with remissions and exacerbation. The intermittent exacerbation of symptoms has been explained by most authors as occurring because the inflated cyst causes some degree of spinal cord compression, when cerebrospinal fluid pressure is temporarily raised and fluid enters the cyst on straining and coughing

Treatment of extradural arachnoid cysts is complete surgical removal with an excellent prognosis regardless of degree of cyst size. Symptomatic cysts are primarily treated with excision and obliteration of the communicating dural defect. The mainstay of treatment in patients with symptomatic neurological deterioration from spinal extradural arachnoid cysts is complete excision of the cyst, followed by obliteration of the communicating pedicle and watertight repair of the dural defect to eradicate the ball-valve mechanism.

MANAGEMENT OF ARACHNOID CYSTS :

The indications for the surgical treatment of asymptomatic arachnoid cysts is still a controversy. Patients with symptomatic cysts

causing seizures, hydrocephalus, increased intracranial pressure or neurologic impairment should be treated.

The surgical approaches used to treat arachnoid cysts are basically of two types [24, 25]

1. Craniotomy with cyst excision or fenestration of cysts into the subarachnoid space, basilar cisterns or ventricles and
2. Cystoperitoneal shunt placement .

Craniotomy with fenestration of an arachnoid cyst is sufficient treatment in approximately 60% of patients, and the rate can be even higher in patients without hydrocephalus or macrocephaly [26]. When successful, fenestration confers the benefit of shunt independence. There are, however, well-described risks associated with craniotomy and fenestration. Craniotomy with excision of the cyst wall and fenestration into the basal cisterns permits direct inspection of the cyst and avoids placement of a permanent shunt in some cases. However, it is associated with reaccumulation of cerebrospinal fluid at the cyst site. In addition, significant morbidity and mortality may accompany. Abrupt displacement of brain structures following the rapid decompression that accounts for the unexpected rapid deterioration.

Shunting procedures [26, 27, 28, 29, 30,31] may also treat the underlying origins of impaired cerebrospinal dynamics and elevated pressure and

may offer a lower initial risk profile than fenestration. Low pressure shunt is preferred. However, shunt procedures frequently require reoperation and are associated with the lifelong burden of potential shunt malfunction, shunt infection, and overdrainage [32]. Shunting the associated hydrocephalus alone will only worsen the symptoms and may increase the size of the arachnoid cyst.

Samuel F. Ciricillo et al [33] in their study of 40 pediatric patients with arachnoid cysts treated, compared the effects of fenestration and shunting. They concluded that cysto-peritoneal or cyst-ventriculoperitoneal shunting is the procedure of choice for arachnoid cysts in most locations, including those in the middle cranial fossa.

Griffith Rutherford Harsh et al [34] reviewed the clinical and radiographic findings, surgical treatment and outcome in 16 pediatric patients with intracranial arachnoid cysts. Their study showed that cyst-peritoneal shunting is the treatment of choice for most intracranial arachnoid cysts in children.

J. A. Kandenwein et al [35] in their outcome analysis of symptomatic arachnoid cysts in 37 patients states that surgery resulted in favourable outcome in two thirds of the patients. Both standard procedures, fenestration and shunting, are equally effective for treatment. Factors that influence outcome are the rate of volume reduction and cyst location.

Gabriel Zada et al [36] with a study of forty two paediatrics patients younger than two years, recommend in patients presenting with ventriculomegaly in conjunction with an arachnoid cyst, initial cyst fenestration and ventriculoperitoneal shunt placement in most cases . Better results have been demonstrated when ventriculoperitoneal shunt insertion precedes cyst fenestration. The precise role of endoscopic fenestration with the creation of a third ventriculostomy in such patients remains to be determined and yet is quite promising. In patients presenting with nonspecific macrocephaly in conjunction with an arachnoid cyst, they recommend initial cyst fenestration plus subsequent shunt placement as necessary. In their experience, more than 40% of these patients will remain shunt free. Finally, patients diagnosed due to other presentations should undergo fenestration alone and subsequent shunt placement only as necessary, given that fewer than 10% of these patients will require shunts.

Endoscopic approaches [37, 38] have been used with good results, although the follow-up period has not been long. The goal of fenestration is free communication with the basal cisterns. The choice of the endoscopic approach is mainly dictated by the size and location of the cyst, the size of the ventricular system and the relationship between the third ventricle and the cyst. Endoscopic trajectories were chosen to create areas of communication between the cyst and the ventricular system, the cyst

and the subarachnoid space of the basal cistern or both, when possible. If cysts are adjacent to the ventricular system and the lining walls were thin enough that a fenestration could be performed safely, an opening between the cysts and the ventricles was achieved -cystoventriculostomy.

Konstantina Karabatsou et al [39] report their experience in the management of arachnoid cysts using endoscopic techniques and the use of these techniques in combination with neuronavigation systems. They reviewed thirty nine cases in which patients were treated endoscopically for intracranial arachnoid cysts over a period of eight years. The main objective of the surgery was to marsupialize the cyst into normal basal cisterns or ventricles, depending on the patient's anatomy. For the treatment of associated hydrocephalus an endoscopic third ventriculostomy was combined with the main endoscopic procedure in nine cases.

Federico Di Rocco et al [40] made a study to evaluate the efficacy and safety of endoscopic transventricular ventriculocystostomy in the treatment of intracranial cysts based on the concept of normalizing cerebrospinal fluid dynamics. They concluded that Neuroendoscopic transventricular ventriculocystostomy constitutes a valid alternative to microsurgery for intracranial cysts located within or adjacent to the ventricles. It creates an effective cerebrospinal flow within the cyst with minimal alteration of subarachnoid spaces. It may be combined with an endoscopic third

ventriculostomy procedure in case of obstruction of cerebrospinal fluid pathways and should be preferred to the insertion of shunts.

Joachim M. K. Oertel et al [38] have found that endoscopic cystoventriculostomy represents a useful treatment option for patients with paraxial arachnoid cysts in whom a standard cystocisternotomy is not feasible

Gustavo pradilla et al [1] report on a case series that illustrates the diverse forms of presentation and the treatment modalities commonly used for arachnoid cysts. They say that recent advances in neurosurgical techniques and neuroendoscopy continue to favor fenestration over shunt insertion as the method of choice for initial cyst decompression.

RESULTS

This study was conducted in Government Rajaji Hospital over a period of thirty three months from August 2008 to March 2011. About thirty five patients who had come to the Neurosurgery outpatients department with intracranial and spinal arachnoid cysts were identified and included in the study.

The clinical presentation of the patients with cranial, supratentorial and infratentorial, as well as spinal arachnoid cysts were noted and analysed. The distribution of arachnoid cyst in different age groups were also noted. Patients were subjected to different surgical procedures like arachnoid cyst excision and fenestration to basal cisterns either through craniotomy or through endoscopically, cystoperitoneal shunt and ventriculoperitoneal shunt. Spinal arachnoid cysts underwent either laminectomy or laminotomy and cyst excision. The surgical outcome of the patients were followed up. The complication that arose following surgery and its management and need for a second procedure is also noted.

SEX DISTRIBUTION :

In our study, the majority of patients are females. Female patients was about twenty two, including seventeen adult and five female child. There was about thirteen male patients, including nine adult and four male child. The male to female ratio was about 0.6 : 1.

Table 1

Sex distribution of patients in our present study.

Sex	Number of cases	Percentage
Male	9	25.7 %
Female	17	48.6 %
Male Child	4	11.4 %
Female Child	5	14.3 %
Total	35	100%

AGE DISTRIBUTION :

In our study, the age group of patients at the time of presentation of symptoms varied. The mean age of patients was 33.9 years, ranging from 50 days to 68 years. But the majority of patients presented before 20 years. About nine patients presented before the age of 10 years accounting for 25.7 % of cases. Between 11 and 20 years, ten patients presented accounting for 28.6 %. So about 54.3 % presented before 20 years.

Table 2 : Age distribution of patients in our present study.

Age Group	Number of cases	Percentage
0 – 10 years	9	25.7 %
11 – 20 years	10	28.6 %
21 – 30 years	6	17.1 %
31 – 40 years	4	11.4 %
41 – 50 years	2	5.7 %
51 – 60 years	2	5.7 %
61 – 70 years	2	5.7 %
Total	35	100 %

ANATOMICAL DISTRIBUTION OF ARACHNOID CYSTS :

In our study, supratentorial arachnoid cysts are more common than infratentorial arachnoid cysts. There was about nineteen cases with supratentorial arachnoid cysts, comprising 54.3 %. Twelve patients had infratentorial arachnoid cysts accounting to 34.3 %.

Spinal arachnoid cysts are less frequent than cranial arachnoid cysts. We had four cases of spinal arachnoid cysts in our study.

Table 3 : Anatomical distribution of arachnoid cysts in our study.

Compartment	Number Of Cases	Percentage
Supratentorial	19	54.3 %
Infratentorial	12	34.3 %
Spinal	4	11.4 %
Total	35	100 %

On analyzing the location in each compartment, arachnoid cysts were seen in all locations in our study. Majority of arachnoid cysts were in relation to the cerebral hemisphere in fourteen patients comprising about 40 % of our study group. This includes arachnoid cysts in frontal, temporal and parietal region. Posterior fossa arachnoid cysts are the second commonest location seen in our study in about eight patients comprising

22.9 % of cases. The other locations include arachnoid cysts at sylvian fissure, suprasellar, interhemispheric, cerebellopontine angle, craniovertebral junction.

On analyzing the side of the lesion, the majority of hemispheric arachnoid cysts are on the left side. In our study, ten out of fourteen patients with hemispheric arachnoid cysts were on left side.

Spinal arachnoid cysts are more common in dorsal level. In our study, there was about four cases of spinal arachnoid cysts, in which two were exclusively in dorsal level. Other two patients also had spinal arachnoid cysts in dorsal level, with one extension to cervical level and other to lumbar level. Three patients had extradural arachnoid cysts. One patient had intradural arachnoid cyst. This patient with intradural arachnoid cystin the thoracic level was 3 years old and was the youngest of the patients reported to have intradural arachnoid cyst. The cyst was also seen located anterior to cord.

Table 4 : Location of arachnoid cysts in our study.

Location	Number of cases	Percentage
Cerebral Hemisphere	14	40 %
Sylvian Fissure	2	5.7 %
Sellar	1	2.9 %
Interhemispheric	2	5.7 %
Cerebellopontine Angle	2	5.7 %
Posterior Fossa	8	22.9 %
Craniovertebral Junction	2	5.7 %
Spinal	4	11.4 %
Total	35	100 %

CLINICAL PRESENTATION :

Patients with arachnoid cysts presented with various clinical symptoms and signs. Most of the patients presented with more than one symptom.

Headache was the commonest presentation of patients with intracranial arachnoid cysts. Headache was seen in about twenty patients in our study accounting about 57.1 %. Headache was holocranial in most of the supratentorial arachnoid cyst. There was not of much relationship

between the site of headache and location of arachnoid cysts. However most of the infratentorial arachnoid cysts was associated bifrontal headache associated with vomiting because of ventricular obstruction causing hydrocephalus and raised intracranial pressure. In our present study, seven patients presented with only headache. All these seven patients after imaging found to have supratentorial arachnoid cysts. Nuchal pain was seen in about two patients in our study.

Seizure was the next commonest presentation seen in about eight patients accounting about 22.9%. Weakness of limbs was found in about eight patients, including four cases of spinal arachnoid cysts. Four children with arachnoid cysts presented with enlarging head circumference, before sutural closure. Cerebellar and cerebellopontine angle arachnoid cysts presented with unsteadiness of gait. Other presentation includes enlarging head, neck pain, giddiness, hard of hearing, diminished vision.

Table 5

Clinical symptoms in patients with arachnoid cysts in our study.

Symptoms	Number of patients	Percentage *
Headache	20	57.1 %
Seizure	8	22.9 %
Weakness of limbs	8	22.9 %
Vomiting	5	14.3 %
Unsteadiness of gait	5	14.3 %
Enlarging head	4	11.4 %
Neck pain	2	5.7 %
Giddiness	2	5.7 %
Numbness of limbs	2	5.7 %
Hard of hearing	1	2.9 %
Diminished vision	1	2.9 %
Incessant cry	1	2.9 %
Lethargy	1	2.9 %

*some patients presented with more than one symptoms

MANAGEMENT OF ARACHNOID CYSTS :

Patients included in our study underwent various surgical procedures. Each procedure had its own benefits and drawbacks. About twelve patients underwent craniotomy and excision of cyst or marsupilisation and fenestration. This includes five supratentorial craniotomy and seven suboccipital craniectomy.

Cystoperitoneal shunts was done in eleven patients, ventriculoperitoneal shunts in four patients. One patient underwent endoscopic fenestration of arachnoid cysts. Transsphenoidal excision was done in one patients with suprasellar arachnoid cysts.

One patient with frontoparietal arachnoid cysts in a 18 year old girl who presented with intermittent headache alone was managed conservatively. The patient was kept on followup and the patient was symptom free without any neurpological deficit. Followup scan also showed that the size of arachnoid cyst remained static.

One child with encephalocele was found to have incidental arachnoid cyst. The child was treated for encephalocele and was kept on close follow up. Since the child was asymptomatic and followup scan

showed no increase in size of the arachnoid cyst, the child was treated conservatively.

Spinal arachnoid cysts were treated with either laminectomy or laminotomy and cyst excision. In our present study, among four patients with spinal arachnoid cysts, three underwent laminectomy and one patient underwent laminotomy.

Table 6

Surgical procedures underwent by patients with arachnoid cysts in our study.

Surgical procedure	Number of patients	Percentage
Supratentorial craniotomy	5	14.3 %
Suboccipital craniectomy	7	20 %
Cystoperitoneal shunt	11	31.4 %
Ventriculoperitoneal shunt	4	11.4 %
Transsphenoidal excision	1	2.9 %
Endoscopic fenestration	1	2.9 %
Laminectomy & excision	4	11.4 %
Conservative	2	5.7 %

SURGICAL OUTCOME AND COMPLICATION:

The overall outcome of patients treated for arachnoid cysts in our institution is good, regardless the type of procedure chosen for the patients. But there were also some of the complications which was either treated conservatively or required a second procedure.

In our case series of thirty five patients whom we have taken to study, there was no mortality. The outcome following arachnoid cyst excision and fenestration either by open craniotomy is very good. Similarly, the surgical outcome following cystoperitoneal shunt is also good in our case series. Four patients underwent ventriculoperitoneal shunt, in which three patients developed shunt dysfunction and shunt revision was done. One patient who underwent endoscopic fenestration, recovered well.

All spinal arachnoid cysts in our study, which underwent laminectomy or laminotomy with arachnoid cyst removal had excellent outcome with good neurological improvement.

Table 7

Surgical outcome and complications of patients treated in our study.

Surgical procedure	Per formed	Improved without any complication	Percentage	Complication and management
Craniotomy & excision and fenestration	12	10	83.3 %	Persistent seizure – 1 patient: treated conservatively. Pseudomeningocele with hydrocephalus – 1 patient : ventriculo peritoneal shunt
Cystoperitoneal shunt	11	9	81.8 %	Persistent seizure – 1 patient: treated conservatively. Subacute intestinal obstruction – 1 patient : treated conservatively.
Ventriculo peritoneal shunt	4	1	25 %	Shunt dysfunction – 3 patients : shunt revision done
Endoscopic fenestration	1	1	100 %	Nil
Transphenoidal excision	1	-	-	Reaccumulation of cyst – resurgery
Laminectomy and excision	4	4	100 %	Nil

The most common complication following surgery for arachnoid cysts which we came across in these patients was seizure.. In about two patients who had initial seizure, the seizure persisted postoperatively with maintainance dose of antiepileptic. With higher dose and additional antiepileptic drugs all seizures were controlled.

In a 65 year old patient, with left frontal arachnoid cysts, who underwent craniotomy and marsupilisation, postoperatively seizure persisted which was controlled with antiepileptics. 1 year 6 month followup scan showed complete resolution of arachnoid cyst and patient is symptom free

50 day old male child was initially operated with right ventriculoperitoneal shunt for posterior fossa arachnoid cyst with hydrocephalus. Later the child developed shunt dysfunction twice and the child was reoperated both times with shunt revision. Now the child is symptom free and on periodic followup.

One patient with left frontal arachnoid cyst who had undergone cystoperitoneal shunt, was admitted for subacute intestinal obstruction and got relieved of symptoms with conservative management.

One patient with sellar arachnoid cyst was operated through sublabial transseptal transsphenoidal approach and cyst tapping done. The cyst reaccumulated and needed resurgery.

One patient with posterior fossa arachnoid cyst who underwent suboccipital craniectomy and marsupilisation of arachnoid cyst, later developed pseudomeningocele with obstructive hydrocephalus and required right ventriculoperitoneal shunt.

DISCUSSION

Arachnoid cysts have been recognized with increasing frequency since the introduction of cranial computed tomography and magnetic resonance imaging. They are benign collections of fluid which develop within the arachnoid membrane, containing clear, colorless fluid similar to cerebrospinal fluid. Significant advances have also been made in the surgical management of these lesions.

Arachnoid cysts may remain asymptomatic for several years or during the entire lifetime.

Spontaneous disappearance is only exceptional. With progressive enlargement arachnoid cysts interfere with neural structures or cerebral fluid circulation. Patients can exhibit signs of increased intracranial pressure or focal neurological deficits depending on the cyst location. Acute clinical symptoms can be caused by rupture or bleeding into the cyst. Although children with arachnoid cysts may experience symptoms of intracranial hypertension or lateralizing symptoms, many present with only mild and rather unspecific symptoms such as headache, learning deficit or behavioral disturbances. In infants, increasing head circumference may be the only indication. Nevertheless, in previous studies it has been documented that even cysts that cause only mild and unspecific symptoms

may affect the function of neighboring cerebral tissue,causing impaired cognition, and that such cognitive deficits tend to normalize after surgery.

In the majority of publications concerning symptomatic arachnoid cysts in children, the authors have advocated surgical intervention for these lesions [2]. Nevertheless, some researchers favor a more conservative approach. Cysts in infants and older children have been reported to grow to a substantial size.Such observations would lend support to treatment by surgical decompression.

Optimal treatment for patients with arachnoid cysts remains controversial. Indication for surgery is obvious in patients with signs of raised intracranial pressure, focal neurological deficits, seizures or an additional haematoma. Controversy continues regarding the optimal surgical management. There is an ongoing debate whether to fenestrate (excision of the cyst membrane or opening of the cyst into the subarachnoid space) or to perform shunting of the cyst. Endoscopic fenestration of cysts to minimize surgical trauma has also been introduced recently.

Christian A. Helland et al [2] in their study of forty eight patients over a period of seventeen years and eight months compared the clinical and neuroimaging outcomes following surgical cyst decompression in children in Haukeland University Hospital . The age group they included was 1

month to 15 year. The arachnoid cysts were predominantly in male in their study.

In our present study, at Government Rajaji Hospital, Madurai, majority of arachnoid cysts were found in female patients who presented to the institution, in contrast to other similar studies . Among the thirty five patients we have included in the study, about twenty two female patients constituting about 62.9 % and thirteen male patients constituting about 37.1 %

Sex	Our study	Gustavo Pradilla et al [1]	Christian A. Helland et al [2]	J. A. Kandenwein et al [35]
Male	37.1 %	60 %	79.2 %	64.9 %
Female	62.9 %	40%	20.8 %	35.1 %
Chi square value		p=0.002	p<0.001	p<0.001

Gustavo Pradilla et al[1] compared the distribution of arachnoid cysts in patients presenting to Johns Hopkins Hospital over a period of four year and eleven months with about twenty patients and found that supratentorial arachnoid cysts were more common than infratentorial and spinal arachnoid cysts. In their study about 70 % of patients had supratentorial arachnoid cysts.

J. A. Kandenwein et al [35] studied about thirty seven patients of intracranial arachnoid cysts over a period of ten years from 1991 to 2001. They also found that supratentorial arachnoid cysts are more common.

In our present study we have found similar distribution. Supratentorial arachnoid cysts are more common and found in nineteen patients constituting about 54.3 % of patients. Infratentorial cysts were found in twelve patients constituting about 34.3 % . About 11.4 % of patients had spinal arachnoid cysts in about four patients.

Distribution	Our study	Gustavo Pradilla et al [1]	J. A. Kandenwein et al [35]
Supratentorial	54.3 %	70 %	67.6 %
Infratentorial	34.3 %	5 %	29.7 %
Spinal	11.4 %	25%	-
Chisquare value		$p<0.001$	P=0.011

Our present study had patients with a wide range of age distribution, ranging from 50 days to 68 years. But the majority of patients presented at younger age group. Among the thirty five patients we studied, nineteen patients were below the age of twenty years, which constitute about 54.3 % of the study group.

This age distribution of arachnoid cysts corresponded to the similar studies. Gustavo Pradilla et al [1] also noted in their study, that presentation of arachnoid cysts in wide age group between 2 weeks to 39 years.

The commonest presenting symptom of in arachnoid cysts all study is headache. In our present study, headache was seen in 57.1 % of patients. Headache was seen in about 41 % in Gustavo pradilla et al [1] study, about 59.5 % of patients in J. A. Kandenwein et al [35] and about 31 % in Christian A. Helland et al [2]. The incidence of other presentations like seizure, weakness, hydrocephalus in our study was similar to the related studies.

Symptoms	Our study	Gustavo Pradilla et al[1]	J. A. Kandenwein et al [35]	Christian A. Helland et al[2]
Headache	57.1 %	41%	59.5 %	31 %
Weakness	22.9 %	23%	5.4 %	10 %
Seizure	22.9 %	14%	13.5 %	21 %
Chi square value		P =0.503	P=0.04	P=0.236

In our present study of thirty five patients, there was about thirty one patients with intracranial arachnoid cysts. Two patients who were incidentally found to have arachnoid cysts and was asymptomatic, was

kept under observation. Twenty nine patients who were symptomatic was operated. Majority of them, fourteen patients were operated with cyst excision and fenestration accounting to 48.3% of operated intracranial arachnoid cysts, similar to related studies. In that, five patients underwent supratentorial craniotomy, seven patients underwent suboccipital craniectomy, endoscopic fenestration was done in one case, transsphenoidal excision was done in one case. Eleven patients underwent cystoperitoneal shunt accounting to 37.9 %. Four patients was treated with ventriculoperitoneal shunt.

Surgery	**Our study**	**J. A. Kandenwein et al** [35]
Fenestration	48.3 %	75.6 %
Cystoperitoneal shunt	37.9 %	24.3 %
Ventriculoperitoneal shunt	13.8 %	-
Chi square value	P<0.001	

In our study, four spinal arachnoid cysts was operated, three with laminectomy and one with laminotomy with complete excision of cyst.

Our data illustrate the diverse spectrum of presentations options,and the complications and surgical outcomes in a population treated in a single institution. On patient presentation, clinical decision-making is based on symptomatology and neuroimaging findings. Patients with asymptomatic

or incidental cysts should be monitored clinically and with serial MR imaging. Surgical management should be considered only for increasing cysts causing neural compression, hydrocephalus, or refractory symptoms attributable to mass effect. Surgical treatment options remain controversial and most commonly include either craniotomy, open fenestration of the cyst, stereotactic cyst aspiration, endoscopic cyst fenestration, or shunt placement.

Fenestration through either approach is often preferred to upfront shunt placement to avoid shunt-related complications. Craniotomy and endoscopic fenestration allow inspection of the cyst wall, coagulation of arachnoidal blood vessels and pathological diagnosis confirmation with a tissue biopsy procedure. Fenestration tends to be especially favored over shunting for cyst locations in which vital structures may be injured during shunt placement or following cyst wall collapse.

Advantages of open cyst fenestration via craniotomy include excision of the cyst wall, possible fenestration of multiloculated cysts, and, in certain locations, fenestration of the cyst into neighboring cisterns. Despite the absence of the immediate reexpansion of displaced structures on postoperative imaging, patients report rapid resolution of symptoms such as headache.

Upfront cystoperitoneal shunt insertion has been proposed in patients with concomitant or resultant hydrocephalus as well as in those with arachnoid cyst–related ventriculomegaly that fails to resolve after cyst fenestration. Cystoperitoneal shunt placement remains an appealing option given the simplicity of the surgical technique involved and the availability of intraoperative guidance via ultrasonography or neuronavigation, but complications inherent to all cerebrospinal fluid drainage systems must be considered. The development of slit-cyst syndrome (a condition similar to slit-ventricle syndrome) is also possible following cystoperitoneal shunt placement and should be considered on neurological deterioration in the patient. Reported rates of shunt revision in this patient population are approximately 30%. Endoscopic cyst fenestration has gained popularity with excellent reported outcomes. Magnetic resonance imaging– or computed tomography–guided endoscope trajectories are used, access to the cyst is gained via coagulation of the outer cyst membrane, and generous cystocisternostomies are performed. Neuroendoscopic access has also been used as a complement to open microsurgical fenestration. As this technique gains exposure, minimally invasive fenestration may become the preferred surgical technique for accessible cysts.

Surgical decompression of arachnoid cysts in children yields good long-term outcomes in the majority of patients, with a low risk of

complications or additional impairment. We believe that once the surgical option has been chosen, it should be performed as early as possible to avoid a skull– brain mismatch. An additional advantage of early surgery, at least in theory, is that it prevents pressure from the cyst on the underlying, developing brain. Fenestration of the cyst through a craniotomy seems the treatment of choice because of better outcome and a lower rate of treatment failure.

In this study we had seen that patients with an arachnoid cyst experienced clinical improvement after surgical cyst decompression as well as a significant postoperative reduction in complaints and a better level of overall function. Furthermore, this clinical benefit was accomplished without causing severe complications or additional disability.

Surgery of symptomatic arachnoid cysts resulted in favourable outcome. Both standard procedures, fenestration and shunting, are equally effective for treatment. Factors that influence outcome are the rate of volume reduction and cyst location.

While fenestration of the cysts, either open or endoscopically, has the advantage of leaving the patient shunt independent, there have been reports of considerable recurrences . Shunt placement had been proved to effectively control cyst volumes and related clinical symptoms. It is,

however, accompanied by the possibility of shunt failure or infection . We have no preference of one over the other treatment and our view is to elect the surgical method based on an individual patient, consideration including especially the location of the cysts. Deeply located cysts are eventually better treated with shunting or an endoscopic approach rather than with a major surgery like open fenestration into the basal cisterns. This may help to avoid inadequate manipulation of functioning neural tissue in these cases.

Both surgical options are effective in reducing the preoperative arachnoid cyst volume. Nevertheless, although there were patients with shunting procedures in our series, we observed a higher complication rate with shunts. Therefore we consider fenestration procedures in the first line, whenever possible. This is somewhat contradictory to our finding that volume reduction is more pronounced with shunting, but we believe that complication rates and the possibility of shunt dependency have to be included in treatment considerations as well. If a fenestration procedure fails, the option to insert a shunt system remains available.

CONCLUSION

From our present study both common surgical treatment modalities, fenestration and cyst shunting, revealed good clinical outcome and achieved reduction of the cyst volume in a high number of patients with symptomatic arachnoid cysts. The degree of cyst volume reduction correlated significantly with clinical outcome.

1. Most of the arachnoid cysts in our study presented at a younger age group, commonly in first two decades, as found in other similar studies.

2. Male predominance of arachnoid cyst is found in most of the studies, but we found that most of the patient presented to us with arachnoid cysts were females.

3. All patients with arachnoid cysts in our study were found to be single and sporadic

4. Supratentorial arachnoid cysts were found to be more common than the infratentorial compartment.

5. Though most of the studies show that sylvian fissure arachnoid cyst are most common,in our study in our institution we have seen cerebral hemisphere arachnoid cyst as the commonest followed by posterior fossa arachnoid cyst.

6. Most of the cerebral hemispheric arachnoid cysts occurs on left side, as seen in other studies.

7. Most of our patients with spinal arachnoid cysts were extadural in location, though we had one rare case of intradural spinal arachnoid cyst . Dorsal level is found to be the favoured site for spinal arachnoid cysts from our study.

8. Similar to all other studies reporting the clinical presentation of intracranial arachnoid cysts, in our study, headache is the commonest presenting symptom in most of the patients. Seizure is found to be the next commonest symptom.

9. Most of the patients with intracranial arachnoid cysts in our study have undergone cyst excision with fenestration of cysts , either by open craniotomy or endoscopically. These patients had excellent outcome following surgery.

10. The second commonest surgical procedure done in patients with intracranial arachnoid cysts in our study was cystoperitoneal shunt. These patients also had good clinical outcome following surgery.

11. Few patients with intracranial arachnoid cysts in our study were treated with ventriculoperitoneal shunts. These patients had recurrent shunt dysfunction which needed revision.

12. In our study, all patients with spinal arachnoid cysts who were treated with either laminectomy or laminotomy with cyst excision had excellent outcome with good neurological recovery and without any postoperative complication.

13. In our study, in patients with arachnoid cysts who was operated there was no perioperative mortality. Most of the morbidity was persistent seizure in few cases, which was all managed with increased dose of antiepileptic drug or an alternate antiepileptic drug.

.

BIBLIOGRAPHY

1. Gustavo pradilla, M.D.,and George jallo, M.D. Arachnoid cysts: case series and review of the literature. Neurosurg Focus 22 (2):E7, 2007.
2. Christian a. Helland, M.D., and Knut Wester, M.D., PH.D. A population-based study of intracranial arachnoid cysts: clinical and neuroimaging outcomes following surgical cyst decompression in children. J Neurosurg (5 Suppl Pediatrics) 105:385–390, 2006.
3. R. Seizeur, P. Forlodou, M. Coustans, and P. Dam-Hieu. Spontaneous resolution of arachnoid cysts: review and features of an unusual case. Acta Neurochir (Wien) (2007) 149: 75–78.
4. Luca basaldella, M.D., Enrico orvieto, M.D., Aangelo paolo dei tos, M.D., Mila della barbera, M.D., Marialuisa valente, M.D., and Pierluigi longatti, M.D., Causes of arachnoid cyst development and expansion. Neurosurg Focus 22 (2):E4, 2007.
5. Berle M, Wester KG, Ulvik RJ, Kroksveen AC, Haaland OA, Amiry-Moghaddam M, Berven FS, Helland CA. Arachnoid cysts do not contain cerebrospinal fluid: A comparative chemical analysis of arachnoid cyst fluid and cerebrospinal fluid in adults. Cerebrospinal Fluid Res. 2010 Jun 10;7:8.

6. Di Rocco C, Caldarelli M, Ceddia A. Incidence, anatomical distribution and classification of arachnoidal cysts. In Raimondi A, Choux M, Di Rocco C (eds): intracranial cyst lesions. New York, Springer-Verlag, 1993, 101-111.
7. Gosalakkal JA. Intracranial arachnoid cysts in children: a review of pathogenesis, clinical features and management. Pediatr Neurol 2002;26:93-98.
8. Sundaram C, Paul TR, Raju BV, Ramakrishna murthy T, Sinha AK, Prasad VS, Purohit AK. Cysts of the central nervous system: a clinicopathologic study of 145 cases. Neurology India 2001; 49; 237.
9. T. Spansdahl, O. Solheim. Quality of life in adult patients with primary intracranial arachnoid cysts. Acta Neurochir (Wien) (2007) 149: 1025–1032.
10. Tsitsopoulos P P, Pantazis G C, Syrmou E C, Tsitsopoulos P D. Intracranial arachnoid cyst associated with traumatic intracystic hemorrhage and subdural haematoma. Hippokratia 2008, 12, 1: 53-55.
11. Ganesh Rao, M.D., Richard C. E. Anderson, M.D., Neil A. Feldstein, M.D., and Douglas L. Brockmeyer, M.D. Expansion of arachnoid cysts in children. Report of two cases and review of the literature. J Neurosurg (Pediatrics 3) 102:314–317, 2005.

12. Harun Yildiz, Cuneyt Erdogan, Ramazan Yalcin, Zeynep Yazici, Bahattin Hakyemez, Mufit Parlak, and Ercan Tuncel -Evaluation of Communication between Intracranial Arachnoid Cysts and Cisterns with Phase-Contrast Cine MR Imaging: *AJNR Am J Neuroradiol* 26:145–151, January 2005.
13. H Arai, K Sato, A Wachi, O Okuda, N Takeda. Arachnoid cysts of the middle cranial fossa: experience with 77 patients who were treated with cystoperitoneal shunting. Neurosurgery. 1996 Dec:39 (6):1108-12.
14. Galassi E, Piazza G, Gaist G, Frank F. Arachnoid cysts of the middle cranial fossa: a clinical and radiological study of 25 cases treated surgically. Surg Neurol. 1980 Sep;14(3):211-9.
15. Sprung C, Armbruster B, Koeppen D, Cabraja M. Arachnoid cysts of the middle cranial fossa accompanied by subdural effusions-experience with 60 consecutive cases.Acta Neurochir (Wien). 2010 Oct 8.
16. Parsch CS, Krauss J, Hofmann E, Meixensberger J, Roosen K. Arachnoid cysts associated with subdural hematomas and hygromas: analysis of 16 cases, long-term follow-up, and review of the literature. Neurosurgery. 1997 Mar;40(3):483-90.
17. Gupta SK, Gupta VK, Khosla VK, Dash RJ, Bhansali A, Kak VK, Vasishta RK. Suprasellar arachnoid cyst presenting with precocious puberty : report of two cases. Neurol India 1999;47:148-51

18. Yadav YR, Parihar V, Sinha M, Jain N. Endoscopic treatment of the suprasellar arachnoid cyst. Neurol India 2010;58:280-3.
19. Giuseppe Cinalli, M.D., Paola Peretta, M.D., Pietro Spennato, M.D., Luciano Savarese, M.D., Antonio Varone, M.D., Paola Vedova, Ph.D., Gianpina Grimaldi, M.D., Paola Ragazzi, M.D., Claudio Ruggiero, M.D., Emilio Cianciulli, M.D., And Giuseppe Maggi, M.D. Neuroendoscopic management of interhemispheric cysts in children. J Neurosurg (3 Suppl Pediatrics) 105:194–202, 2006.
20. Stephen J.Price, Karoly M. David, Dominic G.O Donovan, A.Robert Aspoas. Arachnoid cyst of the Craniocervical Junction : Case Report. Neurosurgery, Vol. 49, No.1, July 2001.
21. Muthukumar N: Sacral extradural arachnoid cyst: a rare cause of low back and perineal pain. European Spine Journal vol 11, number 2, april 2002 pages 162 – 166.
22. J. Y. Choi S. H. Kim, W. S. Lee, and K. H. Sung. Spinal extradural arachnoid cyst. Acta Neurochir (Wien) (2006) 148: 579–585.
23. Muthukumar N: Two cases of cervical intradural anterior arachnoid cysts presenting as traumatic quadriplegia. Child's Nervous System vol 20, number 10, oct 2004. pages 757 – 760.

24. Raffel C, McComb JG. To shunt or to fenestrate: which is the best surgical treatment for arachnoid cysts in pediatric patients? Neurosurgery.1988 Sep;23(3):338-42.
25. Bidziński J, Koziarski A. Surgical treatment of intracranial arachnoid cysts. Neurol Neurochir Pol. 1989 Jul-Dec;23(4-6):322-31.
26. Stein SC. Intracranial developmental cysts in children: treatment by cystoperitoneal shunting. Neurosurgery. 1981 Jun;8(6):647-50.
27. Serlo W, von Wendt L, Heikkinen E, Saukkonen AL, Heikkinen E, Nystrom S. Shunting procedures in the management of intracranial cerebrospinal fluid cysts in infancy and childhood.Acta Neurochir (Wien). 1985;76(3-4):111-6.
28. Fewel ME, Levy ML, McComb JG. Surgical treatment of 95 children with 102 intracranial arachnoid cysts. Pediatr Neurosurg. 1996 Oct ;25(4):165-73.
29. Alexiou GA, Varela M, Sfakianos G, Prodromou N. Shunting for the treatment of arachnoid cysts in children. Neurosurgery. 2010 Dec;67(6):1632-6; .

30. D'Angelo V, Gorgoglione L, Catapano G. Treatment of symptomatic intracranial arachnoid cysts by stereotactic cyst-ventricular shunting. Stereotact Funct Neurosurg. 1999;72(1):62-9.
31. Harsh GR 4th, Edwards MS, Wilson CB. Intracranial arachnoid cysts in children. J Neurosurg. 1986 Jun;64(6):835-42.
32. Seung-Ki Kim, Byung-Kyu Cho, You-Nam Chung, Hee-Soo Kim, Kyu-Chang Wang. Shunt Dependency in Shunted Arachnoid Cyst: A Reason to Avoid Shunting. Pediatric Neurosurgery 2002;37:178-185.
33. Samuel F. Ciricillo, M.D. Philip H. Cogen, M.D. Griffith R. Harsh, M.D. and Michael S. B. Edwards, M.D. Intracranial arachnoid cysts in children: A comparison of the effects of fenestration and shunting. J Neurosurg 74:230-235, 1991.
34. Griffith Rutherford Harsh iv, M.D., Michael S. B. Edwards, M.D., and Charles B. Wilson, M.D. Intracranial arachnoid cysts in children. J Neurosurg 64:835-842, 1986.
35. J. A. Kandenwein, H.-P. Richter, and W. Borm. Surgical therapy of symptomatic arachnoid cysts – an outcome analysis. Acta Neurochir (Wien) (2004) 146: 1317–1322.

36. Gabriel Zada, M.D.; Mark D. Krieger, M.D.; Sean A. Mcnatt, M.D.; Ira Bowen, B.S.; J. Gordon Mccomb, M.D. Pathogenesis and Treatment of Intracranial Arachnoid Cysts in Pediatric Patients Younger Than 2 Years of Age. Neurosurg Focus. 2007;22(2) © 2007 American Association of Neurological Surgeons.

37. J U Choi, D S Kim, R Huh Endoscopic approach to arachnoid cyst. childs Nerv Syst. 1999 Jul ;15 (6-7):285-91

38. Joachim M. K. Oertel, M.D., Ph.D., Jörg Baldauf, M.D., Henry W. S. Schroeder, M.D., Ph.D., and Michael R. Gaab, M.D., Ph.D. Endoscopic cystoventriculostomy for treatment of paraxial arachnoid cysts. J Neurosurg 110:792–799, 2009.

39. Konstantina Karabatsou, F.R.C.S. (Sn), Caroline Hayhurst, M.R.C.S., Neil Buxton, F.R.C.S. (Sn), Donncha F. O'brien, F.R.C.S.I. (Sn), and Conor L. Mallucci, F.R.C.S. (Sn). Endoscopic management of arachnoid cysts: an advancing technique. J Neurosurg (6 Suppl Pediatrics) 106:455–462, 2007.

40. Federico Di Rocco, M.D., Masami Yoshino, M.D., And Shizuo Oi, M.D., Ph.D. Neuroendoscopic transventricular ventriculocystostomy in treatment for intracranial cysts. J Neurosurg (Pediatrics 1) 103:54–60, 2005.

PROFORMA

1. NAME OF THE PATIENT : AGE : SEX :

2. ADDRESS OF THE PATIENT :

3. ADMITTING UNIT :

4. IP.NO : NS.NO :

5. DOA : DOS : DOD :

6. CLINICAL PRESENTATION :

7. LOCATION OF ARACHNOID CYST:

Compartment	Location	No of patients
Supratentorial	Hemisphere	
	Sylvian fissure	
	Intraventricular	
	Interhemispheric	
	Sellar	
Infratentorial	Cerebellar hemisphere	
	Cerebellopontine Angle	
	Craniovertebral junction	

spinal	Cervical	
	Dorsal	
	Lumbar	
	sacral	

8. SURGICAL MANAGEMENT :

PROCEDURE	Craniotomy & cyst excision, fenestration	Endoscopic Fenes tration	Cysto-peritoneal Shunt	Ventriculop eritoneal Shunt	Trans-Sphenoidal excision	Laminec tomy& cyst excision
NO OF PATIENTS						

9. SURGICAL OUTCOME :

10. COMPLICATIONS OF SURGERY :

11. RESURGERY :

12. CLINICAL IMPROVEMENT :

13. FOLLOWUP IMAGING :

MASTER CHART

Sl No	Name	Age	Sex	Unit	Ip No	Ns No	DoA	DoS	DoD	Clinical presentation	Cyst Location	Surgical Procedure	Clinical Outcome-complication/ additional procedures
1	Saran ya	14	F	Ns1	72291	5634/07	24/9/07	16/10/07	25/10/07	Right sided cerebellar signs.	Right Cerebello pontine angle Arachnoid Cyst	Suboccipital craniectomy & cyst fenestration	Improved
2	Pitchaia mmal	55	F	Ns3	76665	6693/07	3/10/07	18/10/07	30/10/07	Unsteadiness of gait, neck pain, headache, vomiting, papilledema	Cerebellar Arachnoid cyst Post fossa	Suboccipital craniectomy & cyst excision	Improved
3	Chandra velu	26	M	Ns1	17100	622/08	17/1/08	24/1/08	3/2/08	Headache	Left Temporal Arachnoid Cyst	Cystoperitoneal Shunt	Improved
4	Devadha rshini	2yr 6 Mon	Fch	Ns2	26776	1082/08	5/2/08	16/2/08	25/2/08	Enlarging head ataxic gait. macrocephaly	Posterior Fossa Arachnoid cyst With obstructive hydrocephalus	Cystoperitoneal shunt	Improved
5	Sabeek	26	M	Ns1	53714	6133/08	16/6/08	8/7/08	21/7/08	Headache Left focal seizure – 6 mon	Right Temporal Arachnoid cyst	Right Temporal craniotomy with fenestration	Improved
6	Arulraj	31	M	Ns1	58233	6321/08	22/6/08	29/6/08	8/7/08	Headache , seizure	Left Sylvian Arachnoid Cyst	Craniotomy & fenestration	Improved
7	Mukesh	50 Day	Mch	Ns3	64136	6545/08	5/7/08	10/7/08	19/7/08	Enlarging head size. macrocephaly	Posterior Fossa Arachnoid cyst with hydrocephalus	Right ventriculoperitoneal shunt	Shunt dysfunction twice - Shunt revision twice
8	Pandi	32	M	Ns1	72923	6632/08	16/8/08	28/8/08	8/9/08	Headache, hard of hearing, unsteadiness while walking, left sensorineural hearing loss, left cerebellar signs.	Left Cerebellopontine angle Arachnoid cyst	Suboccipital craniectomy & marsupilisaion Of Cyst	Improved
9	Harini Devi	11	F	Ns2	82991	7112/08	3/10/08	14/10/08	2/11/08	Headache – 1 year, left focal seizure	Right Frontal Arachnoid cyst	Craniotomy & cyst excision	Improved

10	Veeran	50	M	Ns3	83172	7204/08	4/10/08	23/10/08	24/11/08	Diminished vision -2 mon, headache –2wks vomiting. bitemporal hemianopia	Sellar Arachnoid cyst	Sublabial transseptal transphenoidal approach & tapping of cyst	Arachnoid cyst reaccumulated - Resurgery with trans-sphenoidal removal of lesion
11	Malai samy	27	M	Ns3	88123	7620/08	4/9/08	12/9/08	22/9/08	Headache- 6 mon, neck pain – 6 mon, vomiting – 3 mon. papilledema	Craniovertebral junction Arachnoid Cyst	Suboccipital craniectomy & cyst excision	Improved
12	Lingam mal	68	F	Ns3	97740	8041/08	22/11/08	4/12/08	13/12/08	Headache 3 years difficulty in using both lower limb, giddiness paraparesis.	Interhemispheric Arachnoid cyst	Cystoperitoneal shunt	Improved
13	Parames wari	15	F	Ns2	5988	600/09	23/1/09	31/1/09	3/2/09	Headache 3 mon	Left Parietal Arachnoid cyst	Cystoperitoneal shunt	Improved
14	Selva raj	49	M	Ns2	23768	1422/09	9/2/09	19/2/09	26/2/09	Headache, seizure	Left Temporal Arachnoid cyst	Cystoperitoneal shunt	Improved
15	Rajalaks hmi	23	F	Ns1	37153	2795/09	10/4/09	25/04/09	6/5/09	Headache 1 yr weakness of right upper & lower limb	Left Frontal Arachnoid cyst	Cystoperitoneal shunt	Abdomen pain. vomiting - Improved with conservative methods
16	Lakshmi	28	F	Ns2	39153	2853/09	18/4/09	29/4/09	10/5/09	Headache, weakness of right upper and lower limb	Left Frontoparietal Arachnoid cyst	Cystoperitoneal shunt	Improved
17	Samaya Sanjeevi	17	M	Ns2	43289	2901/09	11/5/09	17/5/09	25/5/09	Focal seizures left side 6 yrs, weakness left side 1 yr	Right Temperoparietal Arachnoid Cyst	Cystoperitoneal Shunt	Recurrent seizure - treated conservatively
18	Varnika	9 mon	Fch	Ns3	43897	2985/09	16/5/09	21/5/09	29/5/09	Increasing head size. macrocephaly	Posterior fossa Arachnoid cyst	Cystoperitoneal shunt	Improved
19	Krish nan	3	Mch	Ns3	48875	4179/09	2/6/09	4/6/09	14/6/09	Weakness of both lower limbs. Spastic paraparesis.	D4-D8 Spinal Intradural Arachnoid cyst	Dorsal Laminectomy & excision	Improved
20	Nithya Dhar shini	1yr 9 Mon	Fch	Ns1	58098	4496/09	25/6/09	29/6/09	7/7/09	Incessant cry , vomiting, lethargy	Posterior fossa Arachnoid cyst With obstructive	Right Ventriculoperitoneal shunt	Improved

											hydrocecephalus		
21	Sindhu	18	F	Ns2	59122	4565/09	29/6/09	____	3/7/09	Headache	Left Frontoparietal Arachnoid Cyst	Conservative	Static
22	Pitchaiammal	40	F	Ns2	60560	4624/09	30/6/09	25/7/09	11/8/09	Right cerebellar signs neck pain giddiness. papilledema	Craniovertebral junction Arachnoid cyst	Suboccipital craniectomy & cyst excision	Improved
23	Baby Esther	1	Fch	Ns2	65926	4858/09	26/7/09	4/8/09	12/8/09	Increasing head size . macrocephaly	Posterior fossa Arachnoid cyst With obstructive hydrocephalus	Right Ventriculoperitoneal shunt	Shunt dysfunction - Shunt revision
24	Rajalakshmi	19	F	Ns1	68371	5195/09	29/7/09	6/8/09	13/8/09	Headache	Interhemispheric Arachnoid cyst	Endoscopic fenestration	Improved
25	Kaliammal	65	F	Ns1	69240	5272/09	30/7/09	18/8/09	4/9/09	Headache – 1 yr	Left Frontal Arachnoid cyst	Craniotomy & marsupilisation of cyst	Seizure 1yr 6 mon later - treated conservatively
26	Dinesh Karthik	3yr 6 mon	Mch	Ns3	73715	6161/09	26/8/09	17/9/09	28/9/09	Headache, vomiting – 3 mon	Posterior fossa Arachnoid cyst	Suboccipital craniectomy & cyst excision	Improved
27	Adhi lakshmi	13	F	Ns1	106057	8729/09	24/12/09	____	28/12/09	Headache, seizure	Left Parietal Arachnoid cyst	Cystoperitoneal shunt done In 2004	Right focal seizure - treated conservatively
28	B/O Dhana lakshmi	6 Mon	Mch	Ns3	32601	3133/10	14/5/10	20/5/10	28/5/10	Swelling over root of nose	Right Sylvian Fissure Arachnoid Cyst With Naso ethmoidal Encephalocele	Repair Of Encephalocele. Cyst Observation	Static
29	Murugan	35	M	Ns3	60891	6468/10	11/8/10	2/9/10	4/10/10	Occipital head ache- 6 mon, vomiting. Papilledema	Left Cerebellar Arachnoid cyst	Suboccipital craniectomy And marsupilisation of Arachnoid cyst	Pseudomeningocele with obstructive hydrocephalus - Right VP shunt done
30	Murugeswari	18	F	Ns1	67488	7213/10	6/9/10	15/9/10	23/9/10	Headache	Left Parietal Arachnoid cyst	Cystoperitoneal Shunt	Improved
31	Mahalakshmi	27	F	Ns1	78122	8482/10	2/10/10	20/10/10	29/10/10	Headache, seizure	Left Parietal Arachnoid cyst	Cranitomy & cyst excision	Improved
32	Sudha	17	F	Ns2	73242	8396/10	1/10/10	2/11/10	17/11/10	Numbness & weakness	D11-L1 Spinal	Dorsal Laminectomy &	Improved

										of both LL R – 3 mon, L- 1 mon. paraplegia	Extradural Arachnoid cyst	excision	
33	Syed Ali Fathi ma	13	F	Ns3	79229	8599/10	27/10/10	11/11/10	24/11/10	Weakness & numbness both LL – 40days . Spastic paraplegia.	D3-D9 Spinal Extradural Arachnoid cyst	Dorsal Laminectomy & excision	Improved
34	Samu thiram	51	F	Ns1	91796	9213/10	23/12/10	28/12/10	6/1/11	Headache-1 year	Left Frontotemporal Arachnoid cyst	Right Ventriculoperitoneal shunt	Improved
35	B/O Manime galai	9 Mon	Fch	Ns2	4578	623/11	21/1/11	12/2/11	22/2/11	Weakness of right upper limb with brachial plexus injury	Cervicothoracic Spinal Extradural Arachnoid cyst	Laminotomy and cyst excision	Improved