COMPLICATIONS OF VENTRICULOPERITONEAL SHUNTS IN MANAGEMENT OF CONGENITAL AND ACQUIRED HYDROCEPHALUS AS SEEN AT KENYATTA NATIONAL HOSPITAIJ FROM JANUARY 1983 TO DECEMBER 1987/

BY

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A THESIS SUBMITTED IN PART FULFILMENT FOR THE DEGREE OF MASTER OF MEDICINE (SURGERY) OF THE UNIVERSITY OF NAIROBI.

FEBRUARY 1989

DECLARATION

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THIS THESIS IS MY ORIGINAL WORK AND HAS NOT BEEN PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

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ACKNOWLEDGEMENT

I would like to express my sincere gratitude and appreciation to my Supervisor Prof. G. H. Sande for his guidance without which this work would not have been possible.

Gratitude to my wife Wanjiru and sons Gichuhi and Macharia for their tolerance and understanding during the months of preparing and writing this work.

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INTRODUCTION

Hydrocephalus is an excessive accumulation of cerebraspinal fluid (CSF) within the head due to disturbance of its secretion, its flow, its absorption or compensatory to loss of neural tissue. The latter type is of no surgical importance since there is no increase in the total volume of the Intracranial contents and no rise in intracranial pressure.[3]

Ventriculo-peritoneal shunting of CSF is a procedure used in management of hydrocephalus. CSF is shunted through a tube inserted into one of the lateral ventricles to the peritoneal cavity. A one way mechanical valve is interposed along the course of the conducting tubing to regulate the rate of flow of the CSF.

In the standard procedure a burr-hole is made at the postero-inferior aspect of the right parietal

eminence via a hockey-stick skin incision. A small part of the dura is incised and the ventricular tube inserted. Another incision about 2.5 cm is made 2.5 cm below and parallel to the subcostal margin at mid clavicular line and the peritoneum exposed. The tube is threaded subcutaneously by rail-loading from the scalp incision to the subcostal incision. The breast is avoided when inserting the rail-loading introducer such that the tract does not lie beneath the nipple. The peritoneum is opened after inserting a purse string suture and the distal end of the tube is placed in the suprahepatic space. The peritoneum is closed by tying the purse string around the tube, care being taken not to make it too tight as not to occlude the tube. The scalp and the abdominal incisions are then closed in layers. It is important when inserting the shunt to make sure the mechanical valve is placed in the scalp part of the tract so that functioning

of the system can be tested without opening the wounds. This is done by compressing the collapsible part of the valve against the skull and its filling or non-filling can be ascertained.

This is a retrospective study over a period of 5 years from January 1983 to December 1987, to determine the complications encountered in cases that had ventriculo-peritoneal shunting procedures for management of both acquired and congenital hydrocephalus at Kenyatta National Hospital.

Patients who had their initial shunts inserted before this period but required revision at anytime during this period under study are not included. Also not included in this study were patients offered other types of shunting procedures.

Kenyatta National Hospital is situated in Nairobi,

the capital of the Republic of Kenya. It is a teaching Hospital and the only public Hospital in the Republic with a Neurosurgical Unit hence all cases requiring Neurosurgical management are referred to this unit from all over the Republic.

OBJECTIVES:

The objectives of this study are:-

1) Determine the various indications for ventriculo-peritoneal shunting in the 5 year period.

2) Determine the various complications encountered post-operatively.

3) Determine pre-operative, intra-operative and post-operative factors that predispose to the various complications encountered.

4) Compare the complications encountered at Kenyatta National Hospital with those seen at other centres.

5) Make recommendations on avoidance of preventable complications encountered.

HISTORICAL BACKGROUND

Hippocrates (460 - 377 B.C.) recognizcd that water accumulating in the head caused it to swell. The first clear description of non-communicating hydrocephalus was probably that of Velsalius (1514 - 1564) who described the brain of a child whose ventricles were "so distended that they contained about 9 pounds of water". In this case there was concomitant marked enlargement of the head.[19]

Two centuries later Morgagni noted that this condition occurs in adults without enlargement of the head, a fact not generally appreciated at that time.

A clear delineation between communicating and non-communicating hydrocephalus was the contribution of Robert Whytt (1768) whose 20 cases were of inflammatory origin.

Towards the end of 19th Century, Magendie using animal models showed that the fluid in the ventricles and suborachnoid space was in free communication via a mid-line fourth ventricular foramen which now bears his name. This finding was confirmed by Luschka who in addition described the paired lateral exits of the fourth ventricle which also bear his name.

Though hydrocephalus had been recognized quite early as a clinical entity, the pathology was obscure and no rational methods of therapy had been developed and this was as late as the beginning of the present century.

Attempts to relieve hydrocephalus were made by the Ancient Greeks who practised incision and drainage of the cranium. The removal of fluid by incision or insertion of a trocar was reported by Fabricius Hildanus and was practised in 18th Century. In 19th Century

such tapping of the head were combined with use of compression dressings to prevent re-enlargement. Astringent substances such as tinture of iodine were often injected into the ventricles with disastrous results.

Quincke (1891) the originator of lumbar puncture employed it as a means of relieving hydrocephalus and advocated enlarging the opening in the dura-mater so that the fluid might drain into the surrounding soft tissues in the back and be absorbed.

In modern era, ventricular drainage continued to be popular, whether by trocar, catheter, needle or seton, but these methods often led to fatal Infection. Closed drainage into the scalp was introduced by Frazier with a needle having a broad flange to hold it in place between the outer table of the skull and precranial space. Various other closed procedures have been described.

Payr (1908) had advocated passing a tube from the ventricle to the longitudinal sinus, or jugular vein or common facial vein. He used hardened calve's arteries.

McClure (1909) anastomosed the subarachnoid space to the jugular vein using a venous graft.

Dandy and Blackfan (1913) first proved that CSF is formed within the ventricles principally if not entirely by the choroid plexuses, that 800 – 1000 mis of CSF is formed each 24 hours within the ventricles, that the only escape of the CSF from the lateral and third ventricle is by way of acqueduct of sylivius, the fourth ventricle, into cisterna magna and then into the other subarachnoid spaces, that the absorption of the CSF back into the blood stream is from the subarachnoid spaces directly into the rich capillary beds within the subarachnoid spaces.

The separation of hydrocephalus into communicating and non-communicating variety by means of intra-ventricular injection of a dye was introduced by Dandy and Blackfan (1914).[28] They used 1 ml of neutral sterile solution of 6 mg of phenosulphanethalein and if communication was present, dye would be visible in fluid obtained by lumbar puncture in 6 - 8 minutes.

In 1918, Dandy proposed destruction of the choroid plexus within the lateral ventricles to reduce formation of CSF, but despite the fact that the rationale of the operation was sound, it was technically poor. The sudden evacuation of the fluid from the ventricles was followed by collapse of the thinned out cerebral cortices with severe shock and resulted in operative mortality of 757..

Putman and Scarf (1935) working independently demonstrated that endoscopic cauterization of choroid plexus without allowing escape of CSF

decrease the mortality. Coagulation or resection of the choroid plexus in most part has been discarded being effective only in those cases in which minor imbalance exists between production and absorption of CSF or in case of Incomplete obstruction. The procedure is also technically difficult where the ventricles are not markedly enlarged.

Dandy (1922) devised 3rd ventriculostomy for non-communicating hydrocephalus. The procedure however had one serious fault, namely that it required deliberate section of one healthy optic nerve. Storkey and Scarf (1936) modified an instrument passed through the ventricle to create a 2nd opening in its floor behind dorsum sellae providing drainage into the cisterna interpendicularis. The stoma however failed to remain patent.

Since 1939, there has taken place great resurgence

of interest in hydrocephalus and many new operations have been developed for its treatment. These new procedures employ tubes of rubber, plastics, or metal to drain CSF from one part of CSF system to another part of it or to other body cavities and often remote from the central nervous system. In addition to the simple conducting tubing, many of these techniques require the introduction of mechanical one way valves of plastic or metal interposed along the course of the conductive tubing to prevent the flow of blood or other body fluids towards CSF cavities or spaces and at the same time regulating the flow of fluid. These operations are the so called CSF "shunts". They have been used to drain CSF into practically every body cavity, organ system and tissue spaces within the body.

Torkildsen (1939) described ventriculocisternostomy for non-communicating hydrocephalus only. Norsick (1950) described ventriculo-mastoid shunt. Nulsen and Spitz (1952) described ventriculo-auricular shunt

with a special valve (Holter) interposed along the course of the shunt. Forrest et al (1957) described ventriculo-subdural shunt.

Pudenz et al (1957) described a new ventriculo-auricular shunt in which the valve was placed within the right auricle of the heart. In Kenyatta National Hospital between December 1975 through October, 1976, 51 patients were offered ventriculo-auriculostomy for infantile hydrocephalus, no ' operative mortality was encountered and early complications were not common. Late complications in this series however were not documented since the follow up period was short (Sande 1978).[26]'

Ransonhoff (1954) described ventriculo-pleural shunt applicable in treatment of both communicating and non-communicating hydrocephalus.

Matson (1951) described ventriculo-ureteral shunt, but this technique was surgically unsound since it

required deliberate nephrectomy on the side of the shunt. Harsh (1954) described ventriculo-salpingostomy and Smith et al (1954) ventriculo-cholecystostomy.

Newman et al (1959) described Lumbar-arachnoid-iliostomy. In the same year, Yokoyama et al described a shunt from ventricles to thoracic duct. Parkinson and Jain (1961) described a shunt from cerebral ventricles into the stensons duct of parotid salivary gland.

Ventriculoatrial and ventriculojugular procedures for many years were regarded as the best shunting procedures. Significant major complications including septicaemia, endocarditis, thromboembolism pulmonary hypertension, superior venacaval sydrome, cardiac foreign body, glomerulonephritis and a high revision rate (more than 40%), however have led to their disfavour in the eyes of many neurosurgeons. More recently, the ventriculo-peritoneal shunt procedure has become a popular operation to achieve CSF diversion. [10]

The first ventriculoperitoneal shunt is probably attributable to Kausch.[20] In 1908, he reported on a patient whom he connected a lateral ventricle to peritoneal cavity using a rubber tube. The patient died 20 hrs post operatively and death was attributed to overdrainage of CSF. Subsequently, other surgeons also reported discouraging results with ventriculoperitoneal shunting.

Revival of ventriculoperitoneal shunting has been attributed to Cone (1949) though he never published his results.[3,4,9] The results of ventriculoperitoneal shunts were mixed. Scoff et al (1955) had disappointing results, revision being required 35 times in 32 patients Jackson et al (1955) had 62 patients who required 116 operations. Picaza (1956) reported 907. success in a small series with distal end of the tube placed into the omental bursa.[19]

Scarff (1963) reviewed literature and found 230 reported cases who had ventriculoperitoneal shunts prior to 1963.[28] * Occlusion of the shunt occured

in 587. of cases and mortality rate of 13%. Since Scarff's report, there has been improvement in the . technique with resulting reduction in morbidity and mortality. Ventricular catheters have been designed to lessen the incidence of obstruction by choroid plexus, brain tissue or coaption of the ventricular walls. MLllipore filters are available for use in patients with hydrocephalus secondary to neoplasms that usually disperse into CSF.

Despite these advances there are minor and major complications still encountered and various complications have been reported in the literature following ventriculoperitoneal shunting of CSF.

The following is a list of some of these complications reported so far:-

1) Mcchanical malfunction of valves. [2, 29]

2) Occlusion of catheter by fibrous encasement. [2, 17, 18]

3) Ventriculitis and meningitis. [20, 24,]

4) Wound infection.

5) Intestinal obstruction clue to adhesions. [2, io9]

6) Intestinal volvulus secondary to ventriculo-peritoneal shunt. [31 9]

7) CSF loculations and pseudocyst formation* [2 9 7 9]

8) Small bowel perforation by shunt catheter. [30 9]

9) large bowel perforation by shunt catheter.

10) Migration of shunt catheter Into scrotum [17 23,] resulting In scrotal hydrocele. ' *

11) Metastatic tumour spread by way of shunt.

12) Inguinal hernia occurlng after ventriculo-peritoneal shunting. [, , 10, 11,]

13) Urinary bladder perforation.

14) Shunt catheter disconnection. [10> 18>]

15) Vaginal perforation. [21 9]

16) Sllping of catheter through umbilicus. ^

17) Intragastric migration of the shunt. [20 9]

18) Per oral extrusion of a shunt. [g ']

19) Shunt colonization. [8) U> 33»]

20) Migration of shunt catheter into the chest. [18],

21) Intrahepatic migration of a peritoneal shunt catheter. [32]

Despite the reported complications, shunt malfunction and infection remain the major problems with this type of shunting procedure, [2*] [^oq10^12'] [2°*] *ztif* zy, jj,

The most common cause of infection is staphlococcus albus (epiderdimis), but if any part of gastrointestinal tract is perforated by the catheter tip, then the organism implicated is E. Coli.

The aim of this study is to determine the complications encountered after ventriculoperitoneal shunting procedures done at Kenyatta National Hospital over a five year period 1983 - 1987.

MATERIALS AND METHODS

This is a retrospective study covering a five year period January 1983 to December 1987. The case notes of patients who have had ventriculo-peritoneal shunting procedure for management of hydrocephalus both congenital and acquired were retrived from Kenyatta National Hospital Records Department. The patient's name and in-patient numbers were obtained from the Neurosurgery theatre record book.

All the relevant information was extracted from these files and filled in the data sheet (see appendix). This data was then analysed.

Those patients who had their ventriculoperitoneal shunts inserted before January 1983 but required revision within this period of study were not included in the study.

RESULTS

A total of 128 patients who had ventriculo-peritoneal shunts inserted between January 1983 and December 1987 at Kenyatta National Hospital have been reviewed.

Indications for ventriculoperitoneal shunting were congenital hydrocephalus, intracranial tumours, post-meningitic hydrocephalus and aqueductal stenosis. Table 1 shows the distribution of patients for the various indications. Congenital hydrocephalus presented the highest number of patients, while "aqueductal stenosis" presented the least number of patients. Diagnosis of "aqueductal stenosis" was in an age group older than those with congenital hydrocephalus.

TABLE 1: INDICATIONS FOR VENTRICULO- PERITONEAL SHUNTING.

Indications	Number of Patients	Percentage
Congenital Hydrocephalus	79	61.7
Intracranial Tumours	29	22.7
Post Mrningitic Hydrocephalus	17	13.3
Aqueductal Stenosis	3	2.3
TOTAL	128	100

Sex distribution is as shown in Table 2.

TABLE 2: SEX DISTRIBUTION OF THE PATIENTS WHO HAD VENTRICULOPERITONEAL SHUNTING.

	MALES	FEMALES
Congenital Hydrocephalus	49	30
Intracranial Tumours	18	11
Post Miningitic Hydrocephalus	10	7
Aqueductal Stenosis	3	0
TOTAL	80	48

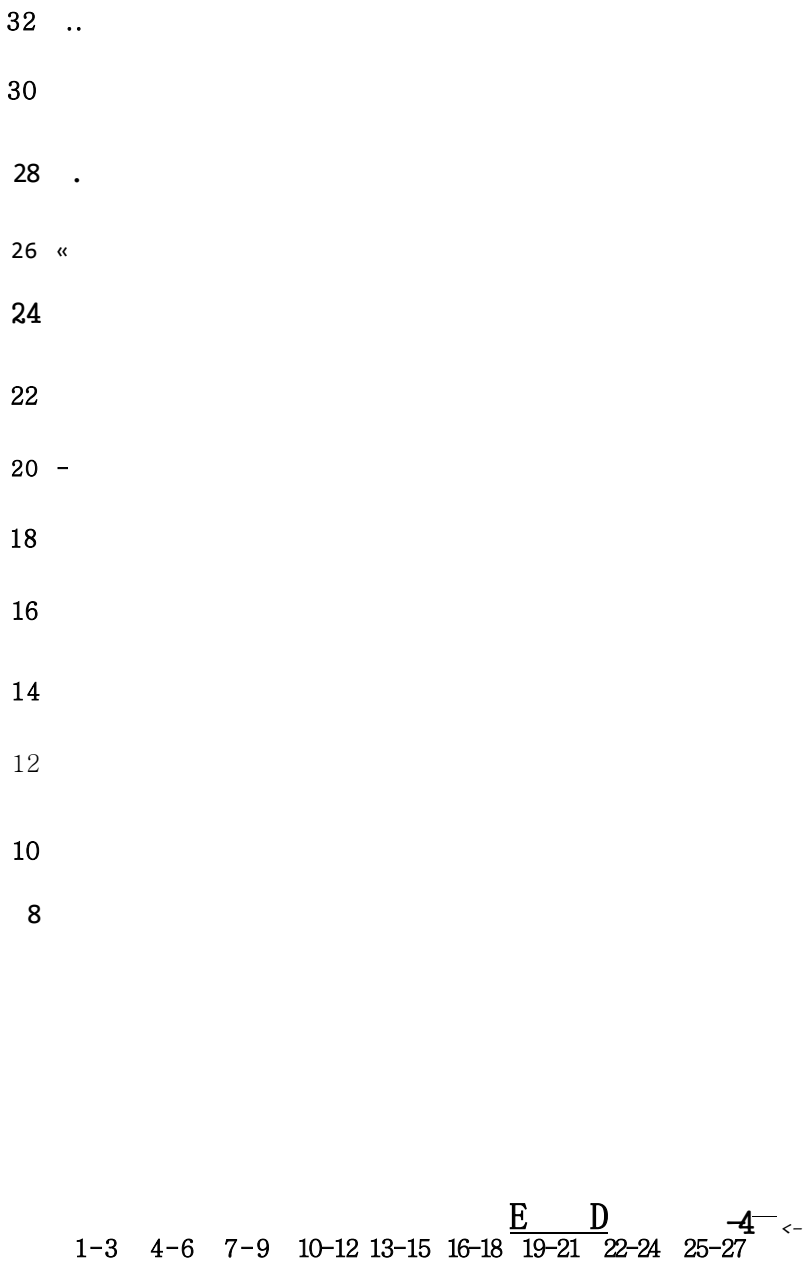
Of the patients who presented with congenital hydrocephalus, 11 had associated congenital anomalies. Seven of them (63.67.) had anomalies related to central nervous system. Table 3 shows the distribution of these congenital anomalies.

TABLE 3: CONGENITAL ANOMALIES IN PATIENTS WITH CONGENITAL HYDROCEPHALUS.

Congenital Anomaly	Number of Patients
Meningocele	5
Occipital Encephalocele	1
Ethmoidal Encephalocele	1
Right Inguinal Scrotal Hernia	1
Umbilical Hernia	1
Cleft Palate	1
Left Brachial Fistula	1
TOTAL	11

Age at presentation for patients who had congenital hydrocephalus ranged from one month to 24 months. Figure 1 is a histogram showing the age at presentation of these groups of patients.

FIGURE 1: HISTOGRAM.SHCWING AT PRESENTATION OF PATIENTS WITH CONGENITAL HYDROCEPHALUS



For the other patients with intracranial tumours, post meningitic hydrocephalus and "aqueductal stenosis" there was no pattern at the age of presentation. Those who had hydrocephalus due to intracranial tumours presented years of age to 60 years. Post meningitic hydrocephalic patients presented from age of 3 months to 11 years, whereas those with "aqueductal stenosis" presented from age of 2 years to 20 years.

COMPLICATIONS ENCOUNTERED

1) Intra-operatlve Deaths

No intra-operative deaths were encountered in this study.

2) Post-operative Deaths

There were eight post-operative deaths noted. Table 4 shows the distribution with the patients who had intracranial tumours having the highest mortality - 757.»

TABLE 4: POST OPERATIVE DEATHS

Cause of Hydrocephalus	Number of Patients	Percentage
Congenita l	1	12.5
Intracranial Tumour	6	75
Postmeningitic	1	12.5
Aqueductal Stenosis	0	0
TOTAL	8	100

The child with congenital hydrocephalus died on the second day following insertion of the ventriculo-peritoneal shunt. The cause of death was not indicated nor was a postmortem done.

The post meningitic hydrocephalic child died on the eleventh day post operatively of bronchopneumonia. At postmortem bronchopneumonia was confirmed but also noted was infection along the shunt tract though there was no evidence of meningitis nor peritonitis.

Patients who had hydrocephalus due to intracranial tumours had the highest mortality comprising 757. of the deaths. There were six patients in number. Two died second day post operatively after insertion of ventriculoperitoneal shunts. Third patient died tenth day after revision of a ventriculoperitoneal shunt which had blocked at both proximal and distal ends. The patient died before

a definite surgery

could be done for what was shown on computerized

tomography to be a 3rd ventricular tumour. Fourth patient died twenty-six days after shunting while undergoing antituberculous therapy for what had been shown on posterior fossa exploration to be a tuberculoma. Fifth patient died 10th day after removal of an infected shunt and another could not be reinserted due to non-availability of shunts. The sixth patient had ventriculoperitoneal shunt done to relieve intracranial pressure due to a cerebellar tumour but died 3 days after a cranietomy for posterior fossa exploration.

No post-mortem examination was done for these six patients.

TABLE 5: VENTRICULOPERITONEAL SHUNTING

PROCEDURES IN 128 PATIENTS

Times Shunted	Number of Patients
Once	99
Twice (one revision)	38
Thrice (two revisions)	18
Four Times (three revisions)	16
TOTAL	171

3) Shunt Revision

The revision rate from these figures would be 33.67.. However 15 patients who had had their shunts removed either due to malfunction or infection could not be reinserted due to various reasons as shown in Table 6. If these 15 patients were to be included, the revision rate would have risen from 33.67. to 45.37.. This rate of revision could have been even higher if there was a good turn up of patients for follow up after

vcntriculoperitoneal shunting procedures. A total of 33 patients were never seen again in the Neurosurgical Clinic after the initial ventriculo-peritoneal shunt.

TABLE 6: PATIENTS WHOM SHUNTS COULD NOT BE REINSERTED AFTER REMOVAL

Reason	Number of Patients
Those who did not turn up for reinsertion	7
Non-availability of V.P. shunts	5
Those who died before shunt was re-inserted	2
Anaesthetic risk	1
TOTAL	15

4) Shunt Malfunction

There were 76 recorded cases of complication encountered out of the 171 shunting procedures done.

Malfunctioning of the shunt system was the commonest complication seen and comprised 29 (38.2%) of the complications. Table 7 shows the causes of the malfunction.

TABLE 7: CAUSES OF THE V.P. SHUNT MALFUNCTION.

Cause of Malfunction	Number of Patients
Blockage proximal end	11
Blockage distal end	11
Blockage both ends	2
Not indicated	5
TOTAL	29

Though the blocking material was recorded as either brain tissue or fibrinous material, none of these specimens were sent for histopathology to determine the actual nature of the blocking material.

5) Infections

Infections were the next common encountered complications and accounted for 25 (32.9%) of the complications. Table 8 shows distribution of the sites of infections encountered.

TABLE 8: SITES OF THE INFECTIONS ENCOUNTERED

Site	Number of Patients
Abdominal wound infection	8
Scalp wound infection	7
Shunt infection	10
TOTAL	25

Few of these cases had pus swab taken and neither were the removed shunts taken for microscopy culture and sensitivity. In those few cases where specimens were taken for microscopy culture and sensitivity, no results were recorded in the patient's

case notes. It is to be noted that no prophylactic or post operative antibiotics were given. Antibiotics after shunt infection were given empirically.

6) Shunt Migration

Shunt migration was noted in 4 instances comprising of 5.2% of the complications. Table 9 shows the distribution of the types of migration encountered.

TABLE 9: TYPES OF SHUNT MIGRATION

Type of migration	Number of Shunts
Proximal end	1
Distal end	1
Prolapse out of ventricle	2
TOTAL	4

In one instant the valve migrated into the ventricle causing malfunction of the shunt system. In two instances the Ventricular end of the catheter prolapsed out of the ventricle. In the last instance, the peritoneal end of the catheter migrated out of the peritoneal cavity after three year follow up. The peritoneal catheter had shortened due to axial growth of the patient and did well after lengthening of the catheter, and reinserting it back into the peritoneal cavity.

Leaking of CSF from Wound

Leaking of CSF from abdominal wounds was seen in 7 instances comprising of 9.27. of the complications encountered. No CSF leakage was noted from the scalp wounds. In five of the cases, the leakage stopped spontaneously but in the other two patients abdominal wound infection supervened necessitating removal of the shunt systems.

Abdominal Distension and Vomiting

Abdominal distension and vomiting was noted post-operatively in 5 instances comprising of 6.6% of the complications.

Miscelaneous Complications

Miscelaneous complications were noted in six instances comprising of 7.9% of the complications encountered. One of these complications was unusual and has not been reported in any literature. The patient had ventriculoperitoneal shunt inserted for congenital hydrocephalus. After discharge from Kenyatta National Hospital developed a swelling of the shunt tract which was diagnosed as an abscess at a peripheral hospital where incision and drainage was done. The incision went through the shunt catheter with consequent leakage of CSF from the wound. Patient did well after revision of the shunt.

Two patients presented with intestinal obstruction after ventriculoperitoneal shunting. At laparatomy

there was small bowel obstruction due to adhesions and perforation of ileum by catheter tip was demonstrated in one of the cases.

One patient had distal end of the shunt tubing protruding through the umbilicus at age of two months, six weeks after ventriculoperitoneal shunting. Patient did well after revision of the shunt.

One patient developed a right scrotal hydrocele two months after insertion of ventriculoperitoneal shunt.

The last patient had ventriculoperitoneal tract swelling which subsided on its own.

DISCUSSION

Hydrocephalus has been described in medical writings since the time of Hippocrates but its treatment has remained a major neurosurgical enigma.

Ventriculoartrial and ventriculojugular procedures, for many years were regarded as the best shunting devices. Significant major complications including septicemia, endocarditis, thromboembolism, pulmonary hypertension, superior venacaval syndrome, cardiac foreign body, glomerulonephritis and a high revision rate (more than 407.) however, have led to their disfavour in the eyes of many neurosurgeons.

More recently the ventriculoperitoneal shunt procedure has become a popular operation to achieve CSF diversion especially after peritoneal tubings were made of silasti which were found to stay open longer. However, like any other shunt system, ventriculoperitoneal shunt is associated with potential complications. This report analyses the experience with this shunting procedure at Kenyatta National Hospital over a 5 year period 1983 – 1987.

A total of 128 patients had ventriculoperitoneal shunting over the period under study, the most frequent indication for peritoneal shunting was congenital hydrocephalus comprising of 61.77. of the cases. Agha [2] had a similar observation. Other indications were intracranial tumours 22.77., post meningitic hydrocephalus 13.37. and aqueductal stenosis 2.37.. The diagnosis was made from history, physical examination and venticulogram where indicated.

Patients with congenital hydrocephalus presented mostly before their first birthday, but there was no particular pattern noted for age at presentation for patients with hydrocephalus due to the other lesions mentioned.

There are no significant statistical sex ratio difference in the different type of hydrocephalus. Similar observation was noted by Sande et al in a review of 168 cases of hydrocephalus. [27,9]

Congenitally hydrocephalic children showed other congenital abnormalities 63.67. of which were

related to central nervous system. These included meningocele, occipital encephalocele and ethmoidal encephalocele.

There were no intra-operative deaths noted in this series though intra-operative deaths have been reported in literature.[19, 24,]

Post operative mortality was highest in patients with intracranial tumours comprising 75% of all deaths recorded. This high mortality in patients with hydrocephalus due to intracranial tumours undergoing ventriculoperitoneal shunting procedure had also been observed by Robertson et al, who noted that the mortality reflected the nature of the primary lesion.

A total of 171 shunting procedures were done on 128 patients under review. This gives a revision rate of 33.6%. However, if the 15 patients who had their shunts removed but could not be revised for one reason or the other as shown in Table 6 are included, the revision rate would have been 45.3%. This rate would

have been even higher if all the patients had turned up for follow up in the Neurosurgical Clinic as advised. A total of 33 patients were lost to follow up after the initial shunt.

In the literature, different authors have reported varying revision rates with a range of 30 - 50%; the longer the follow up the higher the revision rate.[2, 10, 17, 25, 28, 29,] Follow up may have been poor in this series for patients have to travel long distances to get to this hospital.

The revisions as shown in Table 5 were done once in 38 patients, twice in 18 patients and thrice in 16 patients.

Mechanical malfunction (38.2%) and infection (32.9%) accounted for most of the complications requiring revision. In the literature, mechanical malfunction and infection have also been reported as the main significant problems associated with shunts for treatment of hydrocephalus.[18, 25, 29]

Some authors have indicated that distal end was more involved in malfunctioning of ventriculo-peritoneal shunts.[6, 10, 25, 29] However in this study both proximal and distal ends of the shunts were equally implicated as shown in Table 7.

There is evidence that low grade infection is an important cause of shunt malfunction. Embolization of normal tissues such as brain tissue or choroid plexus via shunt catheter is another important problem.[29] Therefore, it is essential to send the blocking material for both histological and culture and sensitivity examination.

Optimal placement of the shunt catheter and the avoidance of infection in order to reduce the incidence of shunt malfunction has been advised.[29]

The types of shunts used in this series were not indicated in the case notes making it impossible to determine if one particular type of shunt was used of different types. If different types, which particular type was more involved in shunt malfunction.

Infection remains a major cause of morbidity associated with CSF shunting for hydrocephalus and can usually be eradicated only by removing the shunt. Reported infection rates vary from 2 - 39% averaging 10 - 15%. [8, 12] [15, 28, 33]

The high rate of infection in this series - 32.9% may be in keeping with an earlier observation by Masiira-Mukasa who observed "Kenyatta National Hospital like many similar medical institutions in the developing world have a very high rate of post-operative wound sepsis as compared to many similar institutions in the developed countries."

Where there was wound infection or shunt was removed for infection, specimens were not sent for microscopy culture and sensitivity. This made it difficult to choose the correct antibiotic according to sensitivity and therapy was given blindly.

Migration of shunt catheter was noted in 4 instances but in only one instance could the cause be determined,

and this was due to axial growth of the patient leading to migration of peritoneal catheter out of the peritoneal cavity.

Abdominal distension and vomiting post operatively was noted in 5 instances. This has been reported in other series. It is explained by paralytic-ileus induced by GSF especially when large quantitie drain from markedly enlarged ventricles to the peritoneal cavity. These patients did well with fluid and electrolyte replacement and nasogastric tube suction to decompress the gastrointestinal tract.

Extrusion of catheter tip through umbilicus though rare, one case was seen in this series. There were two cases of intestinal obstruction due to adhesions and in one of these cases, small bowel perforation was demonstrated.

One unusual case was noted in the series in which a shunt tract was diagnosed in a peripheral hospital a

abscess where incision and drainage was done, cutting through the shunt catheter leading to leakage of CSF through the wound. No similar case has been reported in the literature. The patient did well after revision of the shunt.

Though spread of neoplasms through ventriculo-peritoneal shunt has been recorded in the literature, none of the patients with hydrocephalus due to neoplasms in this series was followed long enough for this complication to be noted.

CONCLUSION

The following conclusions can be drawn from this study:–

1) There was a high rate of revision of ventriculo–peritoneal shunts in this series.

2) Shunt malfunction and infection were the major causes of revision.

3) There was a poor turn up of patients for follow up especially after the initial shunting procedure.

4) Pus swabs from infected wounds and shunts removed due to infection were not sent for microscopy culture and sensitivity.

5) Histopathological examination of the shunt blocking material was not done.

6) Type of shunt, manufacturer and batch number were not recorded in patients' case notes.

7) Several patients could not be offered shunting procedures in time due to non–availability.

RECOMMENDATIONS

I wish to make the following recommendations

1) Strict aseptic techniques with minimal tissue trauma during insertion of ventriculoperitoneal shunts should be the goal of every surgeon.

2) Pus swabs and shunts removed due to infection to be sent for microscopy culture and sensitivity and an "infection record book" be kept in the ward and examined daily so that any undue rate of wound infection can be detected. Culture and serology of the organisms involved would easily assist in determining the source of infection and give a clue to the point at which preventive measures have broken down.

3) Histopathological examination of the material blocking the shunt to be done so as to determine inflammatory reaction to the foreign

shunt material so that a different type may be inserted during revision, or if the reaction is due to a low grade infection, appropriate measures can be taken.

Type of shunt, manufacturer and batch number to be recorded in patient's case notes so that if there is malfunctioning with a particular type or batch the manufacturer can be informed inorder to take the necessary action.

Patients or guardians to be explained before discharge the necessity for follow up.

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APPENDIX

Patients Particulars:

Name

Sex . . . . . Age

In-Patient Number

Address (Ward)

Date of Admission
(1st) (2nd) (3rd)

*(4th)

Date of Discharge

Occupation

Diagnosis

Other associated conditions:-

1)

2)

3)

Investigations:

Investigations . . . . . /Cont'd

3)

4)

Date/Day of Operation	Indication	Intra-operative Findings.
1)		
2)		
3)		
4)		

Chemotherapy (Antibiotics) Given:-

Pre-operative •<

Intra-operative

Post-operative

Post Operative Comp lications	Investigations	Management of post operative complications.
1)_		
2)		
3)		
4)		

Types of shunts used:–

1)

2)

3)

4)

Cause of Death and Post–mortem finding if donet

Out Patient follow up (Date and Findings)

1st visit

2nd visit

3rd visit

4th visit

Others

Microscopy Culture and Sensitivity results of wound swab or shunt tubings:

1)

2)

Microscopy Culture and Sensitivity results of wound swab or shunt tubings. . . . . /Cont'd

3)