

**“A STUDY ON COMPARISON OF MINIMAL
SEPARATION HYDROCELECTOMY VS.
CONVENTIONAL HYDROCELECTOMY
(JABOULAY’S PROCEDURE)” - AT GOVT.
KILPAUK MEDICAL COLLEGE
HOSPITAL.”**

Dissertation submitted to

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

With partial fulfilment of the regulations

for the award of the degree of

M.S (General Surgery)

Branch-I



Government Kilpauk Medical College

Chennai

May -2018

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled “**A STUDY ON COMPARISON OF MINIMAL SEPARATION HYDROCELECTOMY VS. CONVENTIONAL HYDROCELECTOMY (JABOULAY’S PROCEDURE)**” AT **GOVT. KILPAUK MEDICAL COLLEGE HOSPITAL.**” is a bonafide work of **Dr.SANTHI .A,** submitted to The Tamilnadu Dr.M.G.R Medical University in partial fulfilment of requirements for the award of the degree of M.S. BRANCH I (GENERAL SURGERY) examination to be held in MAY, 2018.

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled “**A STUDY ON COMPARISON OF MINIMAL SEPARATION HYDROCELECTOMY VS. CONVENTIONAL HYDROCELECTOMY (JABOULAY’S PROCEDURE)**” AT **GOVT. KILPAUK MEDICAL COLLEGE HOSPITAL.**” Is a bonafide and genuine research work carried out by me in the Department of General Surgery, Government Kilpauk Medical and Hospital, Chennai-10, under the guidance of our Chief **Prof.Dr.M.ALLI, DGO., MS.,** Government Kilpauk Medical College and Hospital.

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This is to certify that the dissertation titled “**A STUDY ON COMPARISON OF MINIMAL SEPARATION HYDROCELECTOMY VS. CONVENTIONAL HYDROCELECTOMY (JABOULAY’S PROCEDURE)**” within General Surgery Department at **Govt. Kilpauk Medical College Hospital.**” is a bonafide research work done by post graduate in M.S. General Surgery, Government Kilpauk Medical College & Hospital, Chennai-10 under my direct guidance and supervision in my satisfaction, in partial fulfilment of the requirements for the degree of **M.S. General Surgery.**

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CERTIFICATE – II

This is to certify that this dissertation work titled entitled dissertation “**A STUDY ON COMPARISON OF MINIMAL SEPARATION HYDROCELECTOMY VS. CONVENTIONAL HYDROCELECTOMY (JABOULAY’S PROCEDURE)**” of the candidate **Dr. A. SANTHI.** with Registration Number **221511161** for the award of **M.S** degree in the branch of **GENERAL SURGERY.** I personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **7%** of plagiarism in this dissertation.

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ACKNOWLEDGEMENT

I am most thankful to **Prof.Dr. P. VASANTHAMANI, M.D., D.G.O.,MNAMS.,DCPSY.,MBA**, Dean, Kilpauk Medical College and Hospital for giving me the opportunity to conduct this study in the Department of General Surgery, Government Kilpauk Medical College & Hospital, Chennai-10.

I thank **Prof.R.KANNAN, M.S**, Professor and Head of the department of General Surgery for his relentless care and concern that he has provided me to bring out this dissertation.

My deepest gratitude to my guide and mentor **Prof.M.Alli, DGO., M.S.**, Professor of the DepartmentDepartment of General Surgery, Kilpauk Medical College, who has inspired me immeasurably during my training as a post graduate student.

I also acknowledge the valuable advice and inputs received from **Dr. Sridevi, M.S, Dr. Ramachandran, M.S and Dr.Suguneshwaran, M.S**, in shaping up this study.

This study would have not been possible without the support of my fellow post graduates and interns who have been a source of help in need.

The most important part of any medical research is patients. I owe great deal of gratitude to each and every one of them.

I would like to thank God for the things he has bestowed upon me.

I would like to thank my parents for making me who I am today and for supporting me in every deed of mine.

I thank each and every person involved in making this manuscript from inception to publication.

INSTITUTIONAL ETHICS COMMITTEE
GOVT. KILPAUK MEDICAL COLLEGE,
CHENNAI-10

Protocol ID. No.08/2017 Meeting held on 17.04.2017

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A Study on Comparison of Minimal Separation hydrocelectomy Vs Conventional Hydrocelectomy (JABOULAY'S PROCEDURE)" submitted by Dr.A.Santhi, M.S. (General Surgery), PG Student, GKMC, Chennai-10

The Proposal is APPROVED

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

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INTRODUCTION

Hydrocele is a abnormal collection of serous fluid in some part of the processus vaginalis, generally the tunica. Hydrocele is the most common benign swelling of the scrotum. The occurrences of hydrocele are estimated as 1% among the adult male population. “Primary vaginal hydrocele is well-defined as abnormal accumulation of serous fluid in tunica vaginalis.” Secondary hydrocele occur subordinate to disease of the testes and epididymis and its management mainly comprises of treatment of the underlying cause. Filarial hydrocele and chylocoele account for 80% of hydrocele in some humid countries where the parasite, *Wuchereria Bancrofti*, is endemic.

Hydrocele is very common appearance in tropical countries especially where filariasis is dominant. In India the highest incidence is seen along the coastal belt where the filariasis is common. Aspiration and sclerotherapy with doxycycline are the main nonsurgical treatment option for the hydrocele. Aspiration and injection of sclerosant can cause severe pain, and simple aspiration has to be recurrent and carries risk of infection and haematoma formation. Hydrocelectomy remains the treatment of choice for the

management of hydroceles. Surgery has been the normal and traditional treatment of choice for hydrocele and which is relatively simple and usually known.

Surgical treatment of idiopathic hydrocele comprises basic techniques—Winkelmann's partial excision, Lord's plication and eversion of the sac. Jaboulay's eversion of the sac and radical excision of the sac. Congenital hydrocoele is treated by herniotomy. The most common surgical procedures for the hydrocele are Lord's plication and Jaboulay's procedure. The technique, devised by Lord and it may also apply to repair a hydrocele, and it is quick and relative bloodless since the sac is not dissected. These operations are minor surgical procedures and that can be performed in an out-patient setup with the success rate of 80% to 98%.

Hydrocelectomy through the eversion procedures for hydrocele may cause postoperative discomfort and temporary limitations of normal activities. Also the complications such as persistent swelling, hematoma, infection, chronic pain and decreased fertility.

Complications arise in the following procedures include infection, hematoma formation, persistent swelling or recurrence of the hydrocele and chronic pain. Although hydrocelectomy and

spermatocectomy are done commonly in general urological practices, there is a definite insufficiency of knowledge describing the complication rates for this operations in the peer reviewed literature. Therefore we followed all the hydrocele surgeries done in our hospital to well capture of the incidence of complications following these procedures.

Since this information appears to be under this reported in the previous and current literature. However, now days there are few prospective studies comparing the results of the various surgical techniques.

HISTORY OF THE PROCEDURE

The description of the abdominal cavity parietes to the tunica vaginales and was attribute to Galen in 177 AD. However, the clear cut explanation of the inguinal anatomy and its association to groin hernias and hydrocees was not documented until the 19th century.

JUSTIFICATION OF THE STUDY

Minimal access hydrocelectomy surgery is a novel procedure and there is an adequate literature about the benefits of this surgical technique.

In India, still in many hospitals we are practicing only conventional hydrocelectomy (Jaboulay's procedure) and Lord's plication techniques for the treatment of hydrocele. These techniques have its own complications.

Only a very few publications have studied the benefits of minimal access hydrocelectomy over the conventional procedure and there were no studies which involved Indian population.

AIM AND OBJECTIVES

AIM

The aim of this thesis is to compare the operative outcomes among the primary vaginal hydrocele patients those underwent minimal access hydrocelectomy and conventional hydrocelectomy.

- Postoperative Edema & hardening
- Postoperative hematoma
- Wound sepsis
- Operative time
- Hospital stay

OBJECTIVES

A. PRIMARY

The main objective of this thesis is to compare the post-operative complications among the primary vaginal hydrocele patients those underwent minimal access hydrocelectomy and conventional hydrocelectomy

- Postoperative Edema & hardening
- Postoperative hematoma
- Wound sepsis

B. SECONDARY

To compare the operating time and hospital stay among the primary vaginal hydrocele patients those underwent minimal access hydrocelectomy and conventional hydrocelectomy.

REVIEW OF LITERATURE

HYDROCELE

A hydrocele is an abnormal collection of serous fluid in a part of the processus vaginalis and the tunica vaginalis. The Acquired hydroceles are primary or it is idiopathic, or it is secondary to epididymal or testicular diseases.

- 4.1.1. Aetiology
- 4.1.2. Properties of hydrocele fluid
- 4.1.3. Anatomy of testis
- 4.1.4. Types of Hydrocele

Studies done on complications arising out of various surgeries for hydrocele.

Comparison of the excisional, plication and internal drainage techniques

Comparison of aspiration-sclerotherapy with hydrocelectomy

Complications following hydrocele surgeries

Comparison of minimal Access versus conventional hydrocelectomy.

Additive evidence regarding hydrocelectomy techniques

HYDROCELE

A hydrocele is an abnormal collection of serous fluid in a part of the process us vaginalis and the tunica vaginalis. The Acquired hydroceles are primary or it is idiopathic, or it is secondary to epididymal or testicular diseases.

Aetiology

Various aetiologies have proposed for the formation of hydrocele as follows:

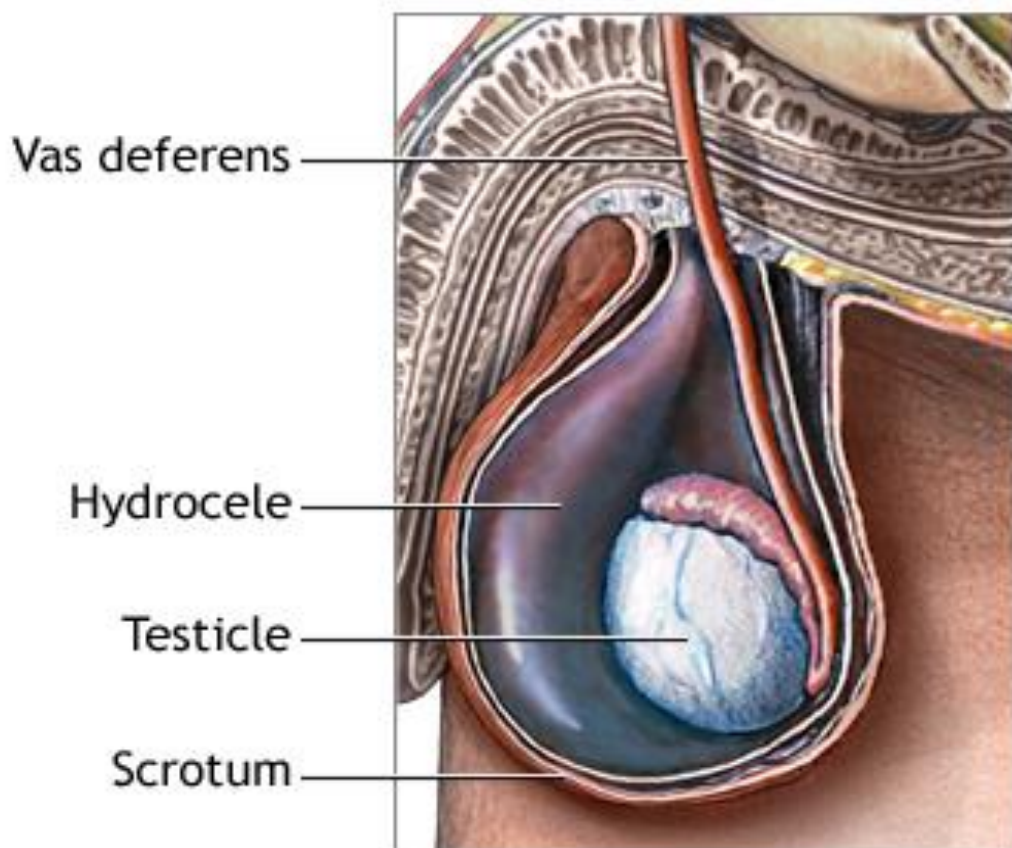
- The defective absorption of fluid by the tunica vaginalis, possibly due to damage to the endothelial wall by low grade infection.
- Excessive production of the fluid as in secondary hydrocele.
- Interference with the drainage of fluid by lymphatic vessels of the cord.
- Communication with the peritoneal cavity.

i.

Properties of hydrocele fluid

It is an amber coloured with specific gravity of 1.022 to 1.024. It comprises water, salts, albumin, and fibrinogen. Per se, hydrocele fluid does not clot, but if it comes in contact with the blood, fibrinogen gets activated and clots decisively. Very often fluid contains cholesterol and tyrosine crystals.

Fig 1 : Anatomy of the hydrocele sac



Anatomy of Testis

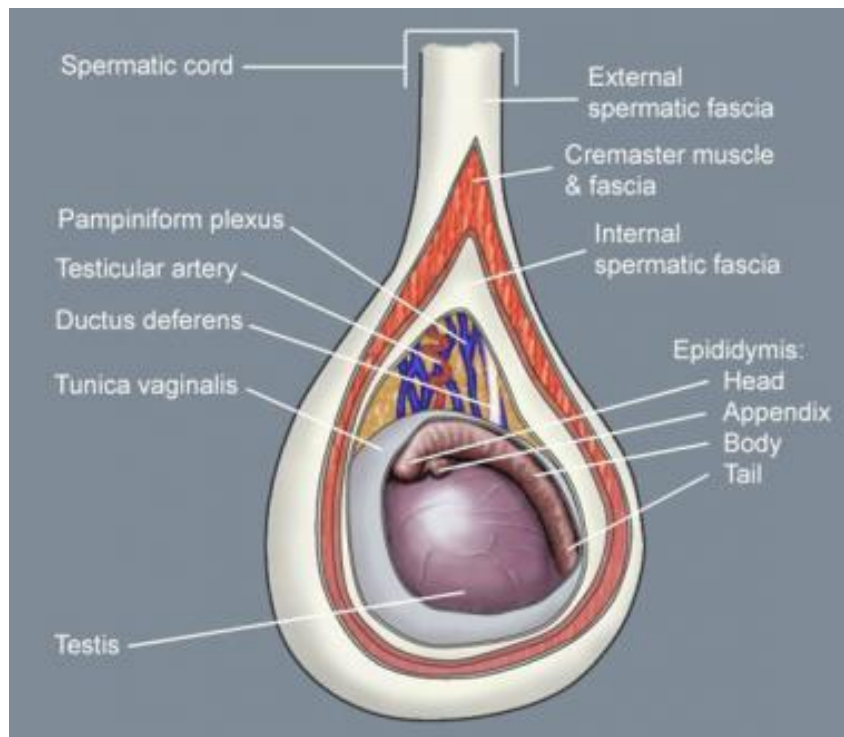
The testis is invested by 3 coats, from outside inwards - the tunica vaginalis, tunica albuginea and tunica vasculosa

Tunica Vaginalis

This is the lower end of the peritoneal process us vaginalis, whose formation precedes to the descent of the foetal testis from the abdomen to the scrotum, after this relocation, the tunica's proximal part from the intestinal inguinal ring almost to the testis, contracts and eliminates, leaving a closed distal sac into which the testis is invaginated. The tunica is reflected from the testis and on to the internal surface of the scrotum, thus it is forming the visceral and parietal layers of the tunica.

Visceral layer

This covers all aspects of the testis excluding most of the posterior part. Postero-medially, it is reflected forwards to the parietal layer and postero-laterally it passes to the medial aspect of the epididymis, lining the epididymal sinus and then it is laterally to its posterior border where it is reflected onwards to become continuous with parietal layer. The visceral and parietal layers are also continuous at both the poles but at the upper the visceral layer surmounts on the head of epididymis before reflexion.

Fig 2: Anatomy of Testis**Parietal layer**

Most extensive than the visceral and it reaches below the testis and ascends in front of and medial to the spermatic cord. The inner surface of the tunica vaginalis has smooth, moist mesothelium, the potential space between its visceral and parietal layers being termed as the cavity of tunica vaginalis.

The tunica albuginea is the stringy covering layer of the testis. It is a dense blue-grey membrane and it consists of bundles of the white fibrous connective tissues, from which it derives its name albuginea and which interlace in every direction.

The tunica albuginea is fully covered by the tunica vaginalis, except at the point where the attachment of the epididymis to the testis, and along with its posterior border, where the spermatic vessels enters.

The tunica vasculosa is present as the vascular layer of the testis and it consists of a plexus of blood vessels are held together by delicate areolar tissue.

Types of Hydrocele

A. Congenital

- Vagin.al hydrocele
- Infantile hydrocele
- True cong.enital hydrocele
- Encysted hydrocele of cord
- Bilocular hydrocele

B. Acquired

- Primary Vaginal Hydrocele
- Secondary Hydrocele
- Recurrentepididymoorchitis due to filariasis
- Tuberculousepididymoorchitis
- Testiculartumours
- Pyocele
- Hematocele

A. Congenital Hydrocele

It occurs due to patent processus vaginalis sac either completely or partially.

Types

1. Vaginal Hydrocele

It occurs when the hydrocele sac is patent only in the scrotum. Vaginal hydrocele is most common form of the primary hydrocele. It usually present in the middle aged or elderly men. This is caused by the collections of amber coloured fluid present between the parietal and visceral layers of the tunica vaginalis.

2. Infantile Hydrocele

The tunica and processus vaginalis (hydrocele) are inflated up to internal ring, but sac has no connection with the general peritoneal cavity.

3. True Congenital Hydrocele

In this condition, the scrotal sac communicates with the peritoneal cavity. It is seen in infants and it may be secondary to TB peritonitis. The scrotal swelling appears when the child assumes an erect posture for a long time and it may not reduce due to inverted ink bottle effect. Hence

the congenital hydrocele is not reducible. It regresses in size and if the child assumes supine position while sleeping.

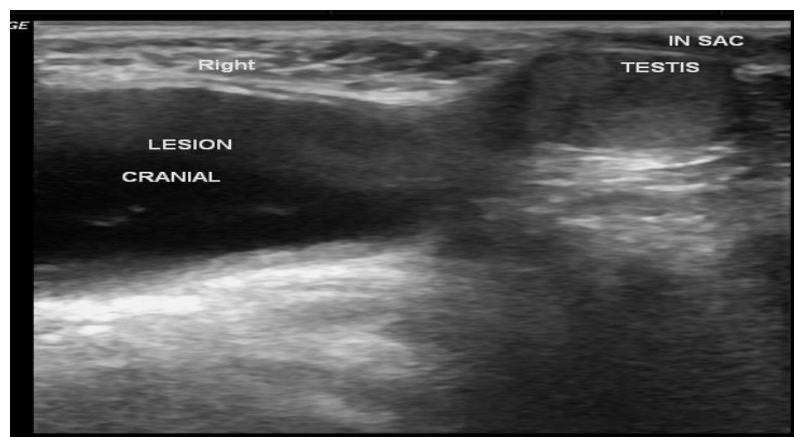
4. Encysted hydrocele of the cord

In this condition, the sac which is obliterated above (inguinal canal) and below (scrotum) but patent at the root of the scrotum around spermatic cord.

It presents a soft, cystic, fluctuant and transilluminant swelling separate from testis, well above the testis.

Diagnosis is established by the traction test. The swelling has got free mobility but when traction is applied to the testis gently, the swelling becomes fixed and it moves down when the testis is pulled down. This variety of hydrocele is treated by the excision of sac.

Fig 3. Image showing Encysted hydrocele of the cord



5. Hydrocele-en-Bissac (Bilocular Hydrocele)

In this type of condition, the scrotal sac communicates with another sac underneath on the anterior abdominal wall musculature. Diagnosis is made by the eliciting cross-fluctuation test.

Other conditions where cross-fluctuation is elicited

- Plunging ranula
- Compound palmar ganglion
- Psoas abscess

6. Hydrocele of canal of Nuck

It presents as a swelling in the inguinal region in female.

The signs and symptoms of Hydrocele of the Canal of Nuck contain the presence of a painless mass of variable size in the groin region. Large cysts may cause abdominal pain and uneasiness. Rarely, the cystic mass may be get infected leading to abscess formation with pain and inflammation.

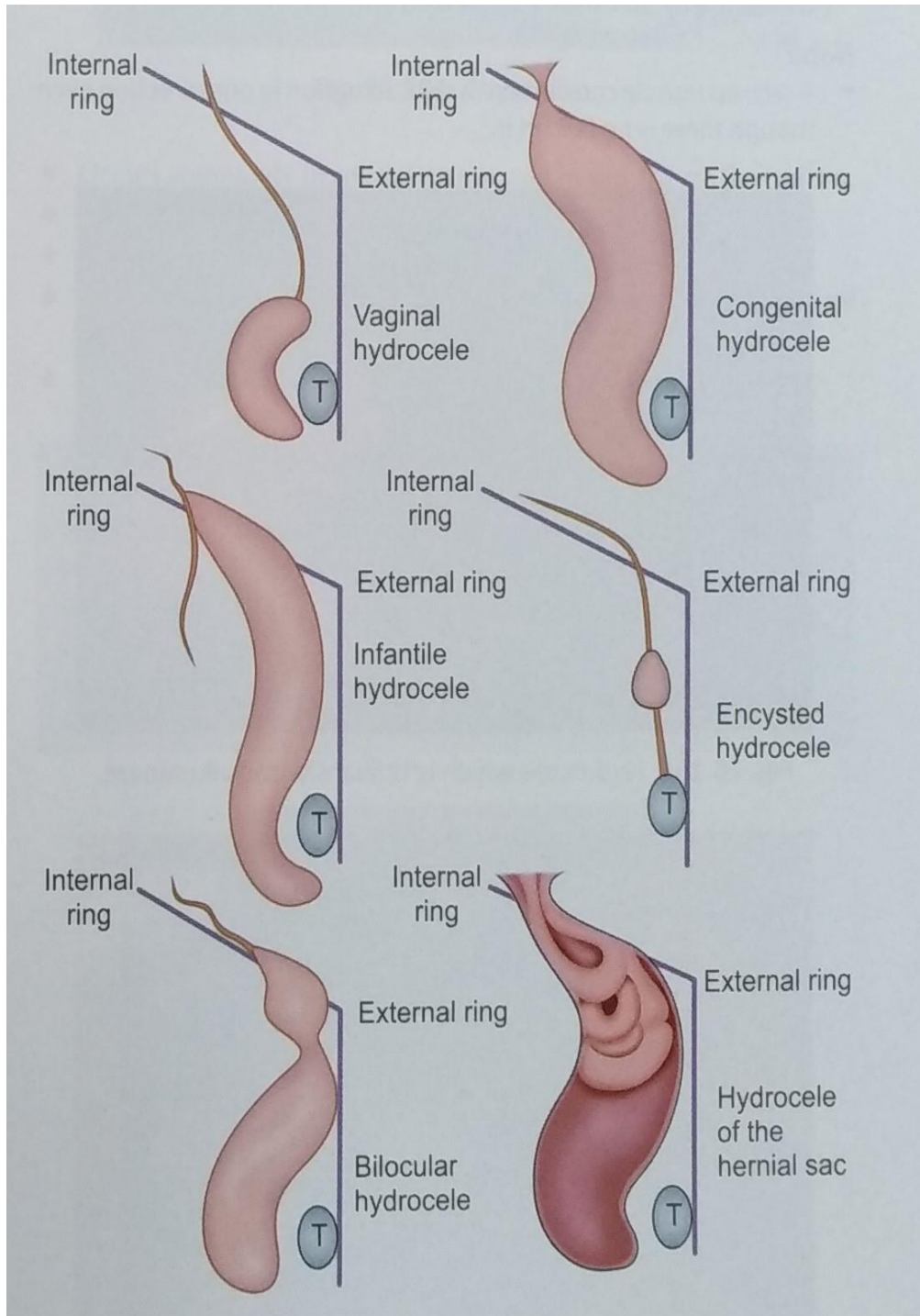
Fig 4. Hydrocele of canal of Nuck



A young girl presented with groin bulge taken for surgery finding was a hydrocele of along the canal of Nuck.

Surgical intervention with complete excision can result in a complete cure. The type of surgery performed is known as hydrocelectomy with high ligation of hernial sac.

Fig 5: Types of Hydrocele



B.Acquired Hydrocele

Primary Vaginal Hydrocele

It occurs usually in the middle aged and common in tropical countries. Testis is not palpable as it is usually attains a large size (unlike secondary hydroceles, which are very small, except in filarial hydrocele). The swelling is fluctuant – elicited by the fixing hydrocele with hand and feeling for the fluid movement by using fingers placed in two perpendicular directions.

The swelling is also transilluminant and elicited in front of the swelling, side by side. But long standing hydrocele is not transilluminant due to the thickened dartos, thickened spermatic fascia, and thickened hydrocele sac and infected content or chylous fluid.

On examination, we can get above the swelling. Testicular sensation can be elicited in vaginal hydrocele by transmitting the pressure sensation through the fluid.

Fig 6: Average size of a hydrocele

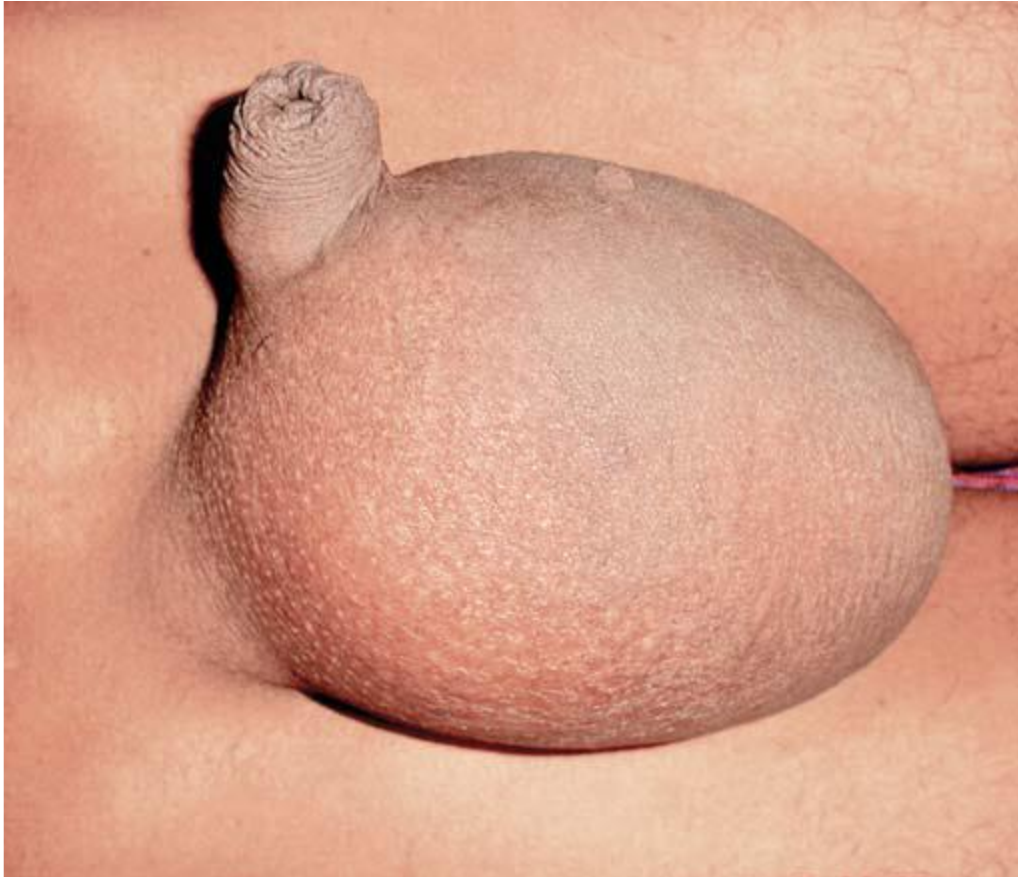


Image showing the patient presented with average sized Hydrocele

Skin over the scrotum is stretched and normal rugosity is lost and subcutaneous vein is very prominent. In case a hydrocele we can see a constriction around the swelling due to tight tunica albuginea at that level.

Fig 7: Get above the hydrocele swelling



The image showings get above the swelling

Get the swelling at the root of scrotum and feel the cord structures.
If there is associated hernia or if the swelling is due to hernia get above the swelling is not possible.

Fig 8: Trans-illumination of the hydrocele swelling

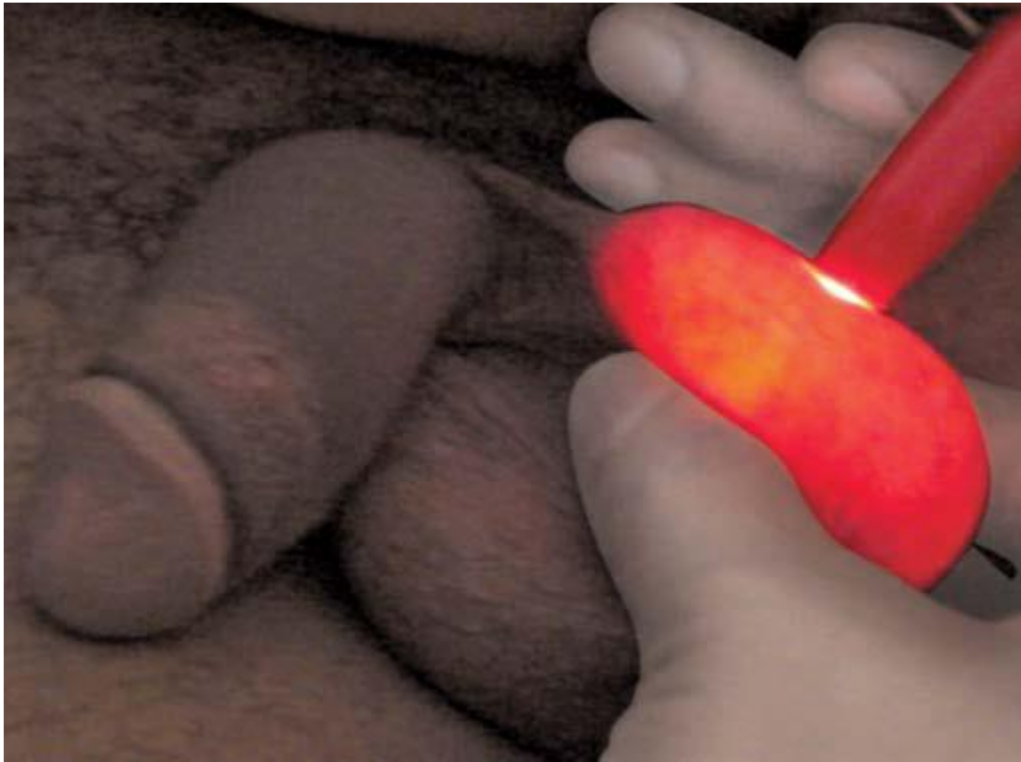


Image showing Transillumination in hydrocele of scrotum

- Perform this test in darkness place the pencil torch laterally over the scrotum blow the light. Place the illuminoscope exactly perpendicular.
- Do not place the illuminoscope posteriorly always place the illuminoscope anterior and light lateral.
- Negative transillumination – pyocele and haemotocele.
- Positvetrans illumination implies that the content is clear hydrocele

Fig 9: hydrocele in USG scrotum

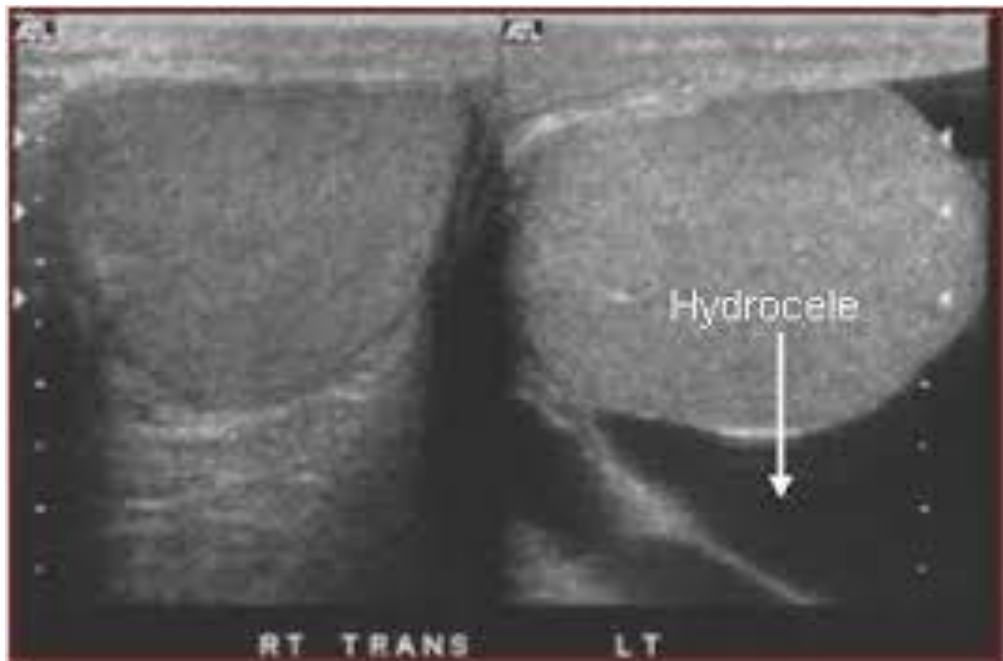


Image showing hydrocele in USG scrotum

Secondary Hydrocele

1. Recurrent epididymo-orchitis due to filariasis

Fluid that accumulates is due to the obstruction of lymphatics. The fluid is milky white in colour. Such hydroceles are called as chyloceles and often do not exhibit intransillumination.

Fig 10: Chylocele



Tuberculousepididymo-orchitis

Retrograde infection from the seminal vessels

Craggy epididymis refers to the rough, hard and irregular surface. This involves the epididymal head and causes fibrosis. So the epididymis feels craggy. Vas deferens feels like a beads and it is called as beaded vas. Secondary hydrocele occurs in 32% of the cases. Eventually it forms a cold abscess which ruptures and results in sinus posteriorly in the scrotum. It never involves in the testis proper.

Testicular tumours

They can present with a swelling of the scrotum, often it is diagnosed as hydrocele. Any young patient with a rapidly growing scrotal swelling could be a testicular neoplasm. Fluid within the sac is hemorrhagic.

Fig 11: Testicular tumours



Testicular ultrasound: the homogeneous tissue of the testicular teratoma on the left of the image produces multiple ultrasound reflections.

Pyocele

It is an infected hydrocele. Infection in a hydrocele and it is rare because of the tunica vaginalis sac which is relatively avascular. However for few cases may get infected resulting in pyocele. These patients present with fever, chills and rigors.

Fig 12: Pyocele



Pyocele—clinical look. US confirm the diagnosis. TC will be raised

Haematocele

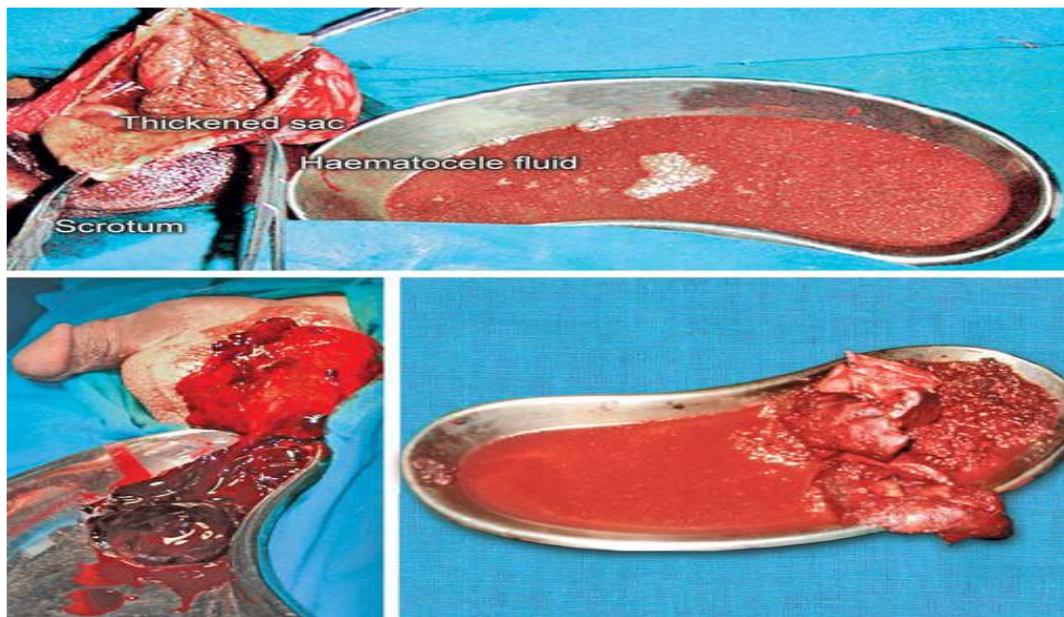
It is a trauma to the hydrocele or spontaneous bleeding into the sac.

Fig 13: Haematocele

It is more important to be able to tell if the testis is intact, because if there is a rupture

Complications of Hydrocele

- Hematocele
- Pyocele
- Calcification of the hydrocele sac
- Rupture of the hydrocele sac
- Hernia of the hydrocele sac

Fig 14: Haematocele

Haematocele in different patients. Orchiectomy is often required in these patients if testis is not viable.

Studies done on complications arising out of various surgeries for hydrocele.

Comparison of The excisional, plication and internal drainage techniques.

A study by **Ku et al.**, “**The excisional, plication and internal drainage techniques - a comparison of the results for idiopathic hydrocele**” compared the results of numerous techniques done for

hydrocele repair. The study was done between January 1992 and June 1998 which included 131 patients diagnosed as hydrocele. The patients were randomized in 3 groups using the excisional technique in the first group which included 81 patients, Lord's plication or eversion technique in 2nd group which included 24 patients and internal drainage in 3rd group which included 26 patients. The 1st group underwent the conventional surgery for idiopathic hydrocele and the excision and eversion of the sac subsequent to it.

The 2nd group underwent Lord's plication technique and the 3rd group underwent internal drainage of the accumulated fluid. The basic principle of internal drainage is the fenestration of the hydrocele sac and by removing parietal tunica vaginalis and layer the opening with the scrotal skin, so that the hydrocele fluid drains through the 'window' which into the tissues superficial to the parietal layer of the tunica vaginalis, and then being absorbed by the lymphatics. The possible complications of the scrotal oedema, hematoma and infection were monitored for 5 days. The reappearance rate was also noted for almost 2 years. There was no significant change among the patients in three groups in the characteristics like age, size of hydrocele, duration of symptoms and follow up duration. Among the complications, even

though the hematoma was seen only among the patients in excision group the difference was not statistically significant.

The wound infection incidence is difference among the 3 groups was also not statistically important. The Oedema was more incident among excision group and followed by plication group and the difference was significant. The recurrence was significantly high among the patients who had internal drainage technique and was negligible among other 2 groups. The study concluded that “application is better than the excision, causing fewer complications, and better than the internal drainage and giving more favourable results.”

Comparison of aspiration-sclerotherapy with hydrocelectomy

Khaniya et al study titled “**Comparison of aspiration-sclerotherapy with hydrocelectomy in the management of hydrocele: A prospective and randomized study**” compared the less invasive aspiration and sclerotherapy technique with surgical hydrocelectomy. The study was done for a period of a year including all unilateral primary vaginal hydrocele patients. Those patients presented with a spermatocele, testicular malignancies and scrotal hematocele or other fertility concerns were excluded.

A total of 61 patients aged from 14 – 78 years were included in the study. Fluctuation and trans-illumination were used for confirmation of the cases. The 62 patients were randomly allocated into two groups of 31 patients using computer generated random numbers. Group 1 was done aspiration with sclerotherapy in OP setting and group 2 was done with hydrocelectomy in day care operation theatre. The study states the procedure done in the both groups.

In group 1

Aspiration of the fluid was done by a 15 gauge intravenous cannula attached to a 50 ml syringe with the three way stopcock and the sclerosant was injected through the same cannula in situ. The volume instilled was 50% of the aspirated fluid up to the maximum of 80 ml. The sclerosing solution was prepared by diluting the mixture of 4 ml of 3% sodium tetradecylsulphate and 6 ml of 2% lignocaine hydrochloride with 70 ml of the normal saline. The concentration of sodium tetradecylsulphate and the lignocaine hydrochloride in the solution was 0.14% each.

In group 2

Jaboulay's procedure (eversion of tunica without excision of sac) was performed under local anaesthesia and drain was not placed. After the intervention, dry dressing with scrotal support was applied for 24 h

and oral NSAIDs (the tablet combination of paracetamol 324 mg and ibuprofen 400 mg) were prescribed 8 hourly for 48 h, then after only on demand basis.” Follow up of patients was done at 48 hours, 1 week, 1 month, 3 months and 6 months. The patients were noted for the incidence of fever, infection, pain, hematoma and recurrence of the swelling. There was no difference in baseline characteristics between the 2 groups. The incidence of pain and haematocele showed as no significant difference between those 2 groups. The incidence of fever and infection were very higher in hydrocelectomy group compared to the sclerotherapy group and the difference was statistically significant. While considering the recurrence, the group 1 presented with 34.6% recurrence after initial sclerotherapy. Out of those 8 patients who underwent the repeat aspiration and sclerotherapy at 3 months, 6 had a recurrence at 6 months. The percentage of the patients satisfied with the procedure increased from 66.66% to 94% over the period of time from 48 hours to 6 months in patients who are all underwent hydrocelectomy whereas in group 1 it decreased from 66.66% initially to 62.9% at 6 months. The major reason for dissatisfaction was the recurrence of the swelling.

Complications following hydrocele surgeries:

A study by **Jin Kyeom Kim et al**, on “**A 10-Year Retrospective Study of the Operative Treatment Results of Adult Type Hydrocele**” evaluated the incidence of complications and the outcomes of patients who underwent hydrocelectomy between January 1996 and December 2005. (12) 289 patients with hydrocele were retrospectively assigned into three groups according to the degree of dissection or the amount of the excision of the hydrocele sac. Group 1 had 78 patients who were treated by surgical dissection and excision of the entire hydrocele sac. Group 2 had 149 patients who were treated by surgical dissection and eversion of the hydrocele sac. The 62 patients present in group 3 underwent operations in which there was little or no dissection of the hydrocele. They analysed the complications, the effects of surgical treatment and the results according to the various surgical techniques in different groups.

The results showed that the duration of recovery showed no differences among the three groups. The overall complication rate was found to be 36.3% among the surgeries. Transient scrotal swelling was present in 28.0% of the patients, hematoma in 2.7%, wound infection in 1.7%, and injury to the epididymis or testis, chronic pain and persistent swelling present in 1.3%. The overall incidence of postoperative

complications was significantly less among the patients in group 3. The rate of scrotal swelling was significantly correlated to the volume of the hydroceles and the amount of the excision of the hydrocele sac. According to them, The long term results of hydrocelectomy were good. The most common complications following scrotal surgery for hydroceles were scrotal swelling, followed by hematoma, wound infection and injury to the epididymis and testis.

Comparison of minimal Access versus conventional hydrocelectomy:

A study by **Saber** (2015), titled “**Minimally access versus conventional hydrocelectomy- a randomized trial**” aimed at comparing the new minimally access hydrocelectomy versus Jaboulay’s procedure regarding operative outcome and patient’s satisfaction.

About 123 adult patients of age 17 to 55 years during the interval of Apr 2008 to Oct 2013 identified as hydrocele were recruited to the study. The study of population was divided into two equal groups. Group A consisted of 61 patients were subjected to conventional surgical hydrocelectomy (Jaboulay’s procedure) while group B consisted of 61 patients were submitted to the new minimal access hydrocelectomy. The cases were confirmed by fluctuations and trans-illumination followed by

the scrotal ultrasound. The randomization of the patients was done using the computer generated random numbers which were sealed inside the opaque envelopes and were opened up before entering the operation theatre. Based on their random numbers they were allocated to either group A (or) B and underwent the corresponding procedure.

Regarding age, duration of symptoms and size of hydroceles, there was no statistical significant difference between the 2 groups of patients. The age of the patients were ranged between 18–56 years with a mean age of 36 ± 11.5 years. The mean operative time in minimal access surgery group was 16.1 ± 4.24 minutes ranged between 12-17 minutes and the mean operative time in the conventional hydrocelectomy group was 32.5 ± 4.76 minutes ranged between 25-40 minutes.

The difference in the operative time between the two surgical procedures was statistically significant ($P \leq 0.02$). The minimal access surgery group had a mean time of hospital stay of 13.47 ± 6.37 hours with minimum of 10 hours and a maximum of 30 hours and while in conventional hydrocelectomy it was 21.19 ± 11.65 hours with minimum of 11 hours and a maximum of 48 hours but the difference work (the

number of days between the day of surgery and the first in the distribution was not significant ($P \geq 0.05$).

The time to return to day a patient returned to work was considered in both the groups and the mean in minimal access surgery group was 8.5 ± 2.1 (7-10) days while in conventional hydrocelectomy group was 12.5 ± 3.53 (10-15) days. The mean time off from work in minimal access surgery group was 9 ± 2.35 days and in conventional hydrocelectomy group was 13.5 ± 4 and the difference was significant ($P=0.0001$).

The postoperative findings taken into account were post-operative hematoma, degree of scrotal oedema, wound infection, patients' satisfaction and recurrence. The overall complication rate in conventional hydrocelectomy group was 36% and in minimal access hydrocelectomy group was 12.88%. Postoperative hematoma was nil in minimal access hydrocelectomy group while 3 patients (4.7%) had mild hematoma in conventional hydrocelectomy group.

Mild and moderate scrotal edema usually subsided within a few days postoperatively while scrotal edema and hardening was considered when the pain and swelling interfered with their daily activities. The

higher incidence of scrotal edema and hardening were found in conventional hydrocelectomy group while scrotal edema and hardening occurred only in 3 patients in minimal access hydrocelectomy group and this difference was statistically significant. ($P \leq 0.05$).

Persistent edema & hardening were confined to the ipsilateral hemi scrotum and required an additional bed rest and anti-inflammatory agents. Cellulitis was mild to moderate, seen in 4 patients in both groups A and B (6.45%). Regarding patient satisfaction, only 2 patients (4.83%) were unsatisfied with the new minimally invasive procedure by the end of second postoperative week, mainly due to scrotal hardening while scrotal edema and hardening was observed in 24.2% those who had conventional hydrocelectomy. Disease recurrence was equal in two groups which was also negligent (1.6%).

Additive evidence regarding hydrocelectomy techniques

Ismail Mihmanli et al titled “**Testicular Size and Vascular Resistance Before and After Hydrocelectomy**” (2) was done with the objective of to determine whether there is an association between hydroceles and testicular size and vascular resistance. The methodology were done as follows. “Twenty-three consecutive patients with the

diagnosis of unilateral idiopathic hydrocele (noncommunicating and noncongenital) who underwent hydrocelectomy were included in the study. At physical examination, the physician was unable to palpate the testis due to the hydrocele. Patients with a history of severe cardiovascular problems, lymphangitis, previous inguinal radiotherapy, and hypoalbuminemia were not included in the study. The duration of scrotal symptoms ranged from 2 to 18 months (mean, 8 months). No underlying cause for the hydrocele was found in any of the patients. Informed consent was obtained from all patients before the sonographic examinations and surgery. The patients were examined in the supine position, with the scrotum supported over a towel tightly draped over the thighs. All the examinations were performed in a temperature-controlled room after the patient had rested for 30 min. All examinations were performed by the same examiner with a high-resolution sonographysystem (Sonoline Elegra, Siemens Medical Solutions) using a 4–9-MHz linear array transducer. The examination protocol included the preoperative evaluation of the hydrocele and pre- and postoperative evaluations of both testes. Preoperative evaluation consisted of identifying the testis with the hydrocele and characterizing the nature of the hydrocele with gray-scale sonography. They also evaluated the internal septations and loculations within the hydrocele to determine

whether it was complicated. The length, width, and anteroposterior diameter of both testes were measured. At least three separate measurements were made on different occasions. The mean of these three separate measurements was used for the calculations. Approximate volume for ellipsoid structures was calculated by multiplying these three diameters by 0.523. The parameters of color Doppler sonography were optimized to display low-flow velocities for evaluating intratesticular blood flow and low-velocity diastolic arterial flow on both the normal side and the side with hydrocele. Spectral waveforms were obtained from at least three different intratesticular arteries. Resistivity index (RI) and pulsatility index (PI) values were determined from these waveforms. The sonography scanner is supported with proper software for direct and automatic calculation of the hemodynamic parameters based on spectral Doppler waveforms. The spectral waveform was manually traced on the strip with calipers, and the RI and PI values were calculated automatically by the software program. Measurements were obtained from three individual waveforms from separate strips. The mean value of three measurements was calculated for each testis. Postoperative measurements included testicular volume and the RI and PI values on both sides. All the calculations and measurements were performed by the method that was described earlier. To avoid having early postoperative changes (edema,

hyperemia, or inflammation) affect RI and PI values, we performed the sonographic examinations at least 2 months after the hydrocelectomy. In all of the patients, the indication for surgery was improvement of the cosmetic appearance of the testis or the patient's wish. Hydrocelectomy with tunical incision in which the fluid is drained and the tunica is everted was performed. The specimen volume was measured after being collected in a bowl right after the incision of the tunica. Care was taken to not manipulate the testes. The program SPSS (version 7.5 for Microsoft Windows, Statistical Package for the Social Sciences) was used for statistical analysis. Testicular volumes and RI and PI values for the normal side and the side with hydrocele were compared before surgery. Both testicular volumes and intratesticular RI and PI values were compared after surgery. The Student's t test for paired samples was used for statistical analysis. Statistical significance was indicated by a p value of less than 0.05. The percentage of difference between the normal and hydrocele testicle measurements (volume and RI and PI values) and the percentage of change in measurements of a single testicle before and after hydrocelectomy were calculated and expressed as mean \pm SD. A single analysis of variance (ANOVA) model was created for each measurement. Volume, RI value, and PI value were included as separate dependent variables. The independent variables were the hydrocele (presence or

absence), surgery (before or after), and patient number (two observations per patient) for each instance. The interactions between the variables of the hydrocele and surgery were also studied separately using ANOVA. A p value of less than 0.05 was regarded as statistically significant.”

The results were stated as “The 23 patients ranged in age from 21 to 72 years (mean age, 42.8 ± 10.8 years). Fourteen patients (60.9%) had right-sided and nine patients (39.1%) had left-sided hydroceles. None of the hydroceles appeared complicated on sonography. All the hydroceles appeared as massive anechoic fluid collections around the testes. The mean volume of hydroceles was 291 mL (range, 242.7–365.4 mL) at surgery.

None of the patients was shown to have a testicular tumor, inflammation, a varicocele, or an inguinal hernia on sonography. Sonography was performed at a mean follow-up of 4.5 months after surgery (range, 2–6 months). None of the patients had recurrence of their hydrocele during this follow-up period. Before surgery, a statistically significant difference was found between the testicular volumes of both sides ($p < 0.001$), and a statistically significant difference in the RI and PI values was found between the normal side and the side with hydrocele (p

< 0.001). After hydrocelectomy, the difference in the testicular volumes before and after surgery on the side of hydrocele was statistically significant ($p < 0.001$). There was not a significant difference in the testicular volumes before and after surgery on the normal side ($p = 0.200$). The side with the hydrocele showed a statistically significant decrease in RI and PI values of intratesticular arteries after hydrocelectomy ($p < 0.001$). A statistically significant difference in RI and PI values was not detected on the normal side ($p = 0.549$ for RI, $p = 0.306$ for PI). The results of the single ANOVA test showed that the volume measurements differed from patient to patient ($F = 3.49$, $p < 0.001$). However, the RI ($F = 1.51$, $p = 0.100$) and PI ($F = 2.60$, $p = 0.566$) values did not. Therefore, although the amount of change in volume varied among individual patients, the changes in RI and PI values were more constant. Also, the presence or absence of hydrocele and the surgical status (before or after) affected all three measurements ($p < 0.001$). When the presence or absence of a hydrocele and surgical status were taken into account, the measurements in the normal testicle did not change after surgery, whereas the measurements in the testicle with the hydrocele did ($F = 67.53$ for volume, $F = 75.13$ for RI value, and $F = 25.15$ for PI value; $p < 0.001$ for all three measurements).”

Ananthakrishnan et al titled “**Surgery for vaginal hydroceles: an update**” (13) states “In men, vaginal hydrocele is the most common morbidity due to *Wuchereriabancrofti*. The only effective treatment for hydrocele is surgery, but safe surgery requires adherence to strict standards for diagnosis, preoperative, intraoperative and postoperative care of the patient. Other scrotal conditions such as chylocele (collection of chyle in the tunica vaginalis), hematocele (collection of blood) or a pyocele (collection of pus) may be mistaken for a hydrocele. These require appropriate management and need to be excluded when making a diagnosis of simple uncomplicated hydrocele. The latter three conditions are characterized by the fact that the contents of the tunica vaginalis sac are non-transilluminant. This test can be used at the peripheral level for differentiating uncomplicated hydroceles from other scrotal swellings. The test is easy to perform, does not require costly equipment other than a good flashlight and an opaque tube of approximately 6' in length and 1' in width. The skill of transillumination can easily be taught to physicians at the appropriate peripheral level. Although there is a report from India suggesting that diethyl carbamazine (DEC) therapy could reduce the size of hydroceles, a recent double blind study in Tanzania showed that DEC has no effect on the size of hydroceles. Hence, surgery remains the treatment of choice for management of filarial hydrocele. Although there

are several publications on surgery of hydrocele and the complications of surgery, this article presents the consensus obtained in a global meeting called under the auspices of the WHO. For management of hydroceles, the levels of health care facilities are classifiable into the following three levels:

Level I: this is at the community level and is meant for detection of patients with scrotal swellings either by the community health worker or the patient presenting himself. Once detected the patient would be referred to a level II facility.

Level II: this is a centre at which surgery for un-complicated hydroceles can be performed. In different countries it would be equivalent to a community health centre or sub-district level hospital with provision for minor surgery. In addition to oxygen and resuscitative facilities there should also be facilities for observation of patients for 24-48 h where required. A trained surgeon or an MBBS physician who is already performing minor surgical procedures can then be trained to perform surgery on patients with hydrocele at the level II facility.

Level III: this would be equivalent to District Hospitals where patients with more serious medical problems or complicated hydroceles can be referred for surgery.

It is essential to examine a patient with a scrotal swelling and differentiate between a hydrocele and other causes of inguino-scrotal or scrotal swellings other than hydroceles as per the algorithm. For this purpose the skill of performing and interpreting a transillumination test is mandatory. All inguino-scrotal swellings and scrotal swellings that are not transilluminant, patients in whom the diagnosis is in doubt, children with hydroceles and those with co-morbid conditions should have ultrasonography to differentiate these swellings. Indications for hydrocele surgery at the level II facility would include medical disqualification due to un-treated hydroceles; interference with work; interference with sexual function; interference with micturition due to the penis getting buried in the scrotal sac; negative impact on the patient's family; dragging pain; liability to trauma in view of nature of patient's work or mode of transportation such as cycling; possible effect on the testis of long standing hydroceles.

Patients with large hydroceles should be given priority in situations where resources may be limited. However, if resources are not an issue, and where the patient may be limited in employment opportunities due to a hydrocele of any size being considered a disqualification for Government jobs (as in India) then, surgery should be offered to all. Preoperative assessment procedures would include evaluation for systemic illnesses such as history of Diabetes Mellitus, other systemic illnesses such as angina, drug allergies, sickling tendency and other problems likely to increase the risk of surgery; haemoglobin, urine and blood sugar; ensuring adequate scrotal hygiene by preoperative bath and scrotal washing with soap and water two times daily for 3 days before surgery, which could reduce the infection rate; surgery should be rescheduled to at least 4-6 weeks after an acute adenolymphangitis;

It is recommended that all the operations for uncomplicated hydrocele in patients without serious comorbidity should be performed under local anaesthesia using either bupivacaine or lignocaine (lidocaine). The procedure should consist of a spermatic cord block with the drug, combined with infiltration along the line of incision.

The procedure for hydrocele should preferably be done as an outpatient procedure. However, observation of the patient for 24-48 h after surgery should be done whenever the situation warrants. The surgeon who performs the operation should be competent to perform hydrocelectomies. It is recommended that the operation performed should be a hydrocelectomy, i.e. a subtotal excision of the parietal layer of the tunica vaginalis leaving a rim of approximately 1-cm width around the testis and epididymis. Aspiration with or without injection of sclerosants was not recommended due to the high recurrence rate and the potential damage to the testis due to the sclerosant. Likewise the procedure of eversion of the hydrocele sac (Jaboulay's procedure) is best avoided due to the following reasons:

In hydroceles, which are larger than tennis balls, the procedure of eversion of the sac is likely to leave the patient with a significant residual swelling of the scrotum;

In hydroceles smaller than tennis balls both procedures, (eversion and excision) are likely to run the same risk of complications;

The tunica vaginalis is abnormal in patients with filarial hydrocele and is best excised. If left behind there are fears in some quarters of possible complications such as a lymph scrotum or a filarial scrotum in some patients. It was, however, accepted that there is insufficient published material to record the instance of such complications, if any;

If improperly performed the procedure of eversion of the sac is associated with a greater risk of recurrence.

Use of chromic gut sutures was recommended to minimize the cost.

Postoperative care is done as follows:

1. Analgesics should be administered starting from the morning of surgery and continued for 48-72 h. The choice of recommended analgesic was oral acetaminophen or NSAIDs other than aspirin.
2. Antibiotics should be administered starting from the night before surgery for a total duration of 5 days. This is to forestall the risk of infection since the patient would return to his home environment to an ambience, which may be conducive to infection. The recommended antibiotic in view of cost and the type of bacteria

likely to be involved in infection was amoxicillin and metronidazole.

3. Patients may be allowed to return to their homes a few hours after surgery except under the following circumstances in which case they should be observed for 24-48 h. Placement of a drain, which has to be removed after 24-48 h undue swelling, pain or oozing from the wound.
4. Hydrocele wounds could be exposed on the third postoperative day and kept dry resulting in less infection from wet dressings and sweating,
5. Patients should be asked to return to the centre 7-10 days later for a follow up visit.

Access issues are addressed as follows:

The issue of patient access for surgery, particularly for hydrocele needs to be addressed. It is felt that the current level of access to surgery in most countries is inadequate. The following are the most possible reasons for the same:

1. Ignorance of patients to the fact that they can be cured of their condition;

2. Fear of surgery and its consequences;
3. Lack of facility or long distance between such a facility and the patient's home;
4. Cost of surgery, hospitalization, transport, loss of wages during and in the postoperative stage.

Training for Surgeons

1. Trainers for training of level II surgeons are to be identified by National Governments/Country co-ordinators. The trainers could be qualified surgeons with experience in hydrocele surgery working in endemic areas (they could also be surgeons attached to teaching or training institutions with experience of hydrocele surgery). The identified trainers need to be trained on the following through a workshop (but case demonstration and actual performance of surgery need not be done during the training),
Surgery protocol for Level II medical officers;

To acquire the ability of Level III surgeons (to be able manage scrotal swelling cases referred to them from level II); to acquire the ability to tackle any complications developed in hydrocele cases operated at level II;

2. The trainers will then train the Level II surgeons identified by national/local health systems. Level II Medical officers need to be trained on diagnosis, testing for fitness for surgery, all aspects of the protocol for surgery, postoperative care and follow up.
3. It would be advantageous to encourage actual performance of surgery during the trainings. This ensures agreement regarding what is meant by certain terms. When actual surgery cannot be done, videotapes of surgery may be substituted.
4. Continuing medical education programmes for medical school teachers, residents and other surgeons, private practitioners on 'Newer developments in the pathogenesis and management of filariasis, protocol for hydrocele management and available information on management of other uro-genital manifestations of filariasis through workshops, round tables, symposia, seminars and exchange visits.

The author concluded as follows:

In men, vaginal hydrocele is the most common morbidity due to *Wuchereriabancrofti*. Diagnosis is straightforward most of the time but when the diagnosis is in doubt ultrasonography is a useful tool to

differentiate these swellings. As the effect of medical treatment with diethylcarbamazine on the size of hydroceles are doubtful, double blind randomized clinical trials are required to generate evidence on the effect of diethylcarbamazine on hydroceles of different grades. The only effective treatment for hydrocele is surgery as the minimally invasive therapy like aspiration and sclerotherapy are known to have high recurrence rates.”

MATERIALS AND METHODS

- * Study Setting
- * Study Duration
- * Study Population
- * Inclusion Criteria
- * Exclusion Criteria
- * Study Design
- * Sample Size
- * Procedure
- * Randomization
- * Pre-Operative Workup
- * Surgical Techniques
- * Conventional Hydrocelectomy (Jaboulay's Procedure)
- * Minimal Separation Hydrocelectomy
- * Study Tool
- * Data Collection and Methods
- * Services rendered

Study Setting:

Dept. of General Surgery, Govt. Kilpauk Medical College,
Chennai.

Study Duration:

6 months (April 2017 – August 2017)

Study Population:

Patients attended the surgery OPD with scrotal swelling for
evaluation

Inclusion Criteria

1. Those subjects diagnosed as primary vaginal hydrocele
2. Those who were willing for the surgery
3. Patients aged 18-56 years
4. Male Gender
5. With diagnosis of hydrocele
6. Patient without comorbidity
7. (TB, HT, DM, asthma, seizure)

Exclusion Criteria:

1. Those patients presented with spermatocele, testicular malignancies and scrotal hematocele.
2. Patients having filarial scrotum requiring scrotoplasty were not included in this study.
3. Secondary hydrocele due to acute infection and malignancy are excluded from the study.

Study Design

The study is conducted as a single blinded Randomized Control Trial with two arms – one arm of subjects with hydrocele who underwent minimal separation hydrocelectomy and the other arm of subjects with hydrocele who underwent conventional hydrocelectomy (Jaboulay's procedure).

Sample Size

Sample size is calculated using the formula:

$$(Z_{\alpha} + Z_{\beta})^2 * 2 * p * (1-p) d^2$$

Where, Z_{α} = two tailed deviate for 95% confidence level = 1.96,

Z_{β} = two tailed deviate for 80% power of the study = 0.84

$$p = (p_1 + p_2) / 2$$

d = difference in incidence of post-operative oedema between subjects underwent minimal access and conventional hydrocelectomy.

p_1 – incidence of post-operative oedema in subjects underwent conventional hydrocelectomy

p_2 - incidence of post-operative oedema in subjects underwent minimal access hydrocelectomy

From the study by Aly Saber “Minimal Access versus Conventional Hydrocelectomy: a Randomized Control Trial”, the incidences of post-operative oedema are considered as, conventional hydrocelectomy patients, $p_1 = 74\%$ and minimal access hydrocelectomy patients, $p_2 = 8\%$.

Therefore,

$$p = (p_1 + p_2) / 2 = (0.74 + 0.08) / 2 = 0.41$$

The sample size is calculated as

$$N = (1.96 + 0.84)^2 * 2 * 0.41 * (1 - 0.41) / (0.74 - 0.08)^2$$

$$N \sim 30$$

The total sample size estimated is 60 with 30 subjects in each arm.

Procedure:

Randomization

The randomization technique was commenced before the start of the procedure. There were 60 sealed envelopes made ready with sequential numbers from 1 to 60. Each envelope contained a computer-generated random number inside it. Based on the last digit of the random number, the subjects were allocated to their respective interventional groups. If the number was between 0 and 4, they were assigned to conventional hydrocelectomy and if the number was between 5 and 9, they were subjected to minimal separation hydrocelectomy. The envelopes were opened by the investigator after getting the consent from the patient just prior to the surgery. Based on the random number, the subjects were allocated and the respective surgeries were done.

Pre-Operative Workup:

Each patient was assessed in detail about their history and complete physical examination was done. Fluctuation and Transillumination was used for confirming the diagnosis of hydrocele. Basic laboratory investigations like complete blood count and urine routine examinations were done.

Inj.ceftriaxone 1gm IV at the time of induction of anesthesia or just after the administration of spinal anesthesia was given followed by another dose 2 h postoperatively.

Surgical Techniques

After the induction of spinal anaesthesia, antibiotic ceftriaxone 1gm iv was given intravenously followed by one more dose 2 hours postoperatively.

Conventional Hydrocelectomy (Jaboulay's Procedure)

The testis was delivered through an incision in the scrotum and the tunica was opened and everted and most of the hydrocele sac was resected with electrocautery and leaving a reasonable cuff along the borders of the testicle.

Bleeding was controlled by a running suture closing the free edges of the hydrocele sac and hemostasis was secured by the aid of electrocautery. Standard 2 layer closure which was used to close the scrotum with small tube drain. Patients were followed up on second day for scrotal edema and hematoma and the drain was removed on third day.

Fig 15: Conventional Hydrocelectomy: Vertical incision of about 6-8 cm in length was made over the scrotum, anteriorly about 1 cm lateral to the median raphe.



Fig 16: Conventional Hydrocelectomy: Bluish hydrocele sac is identified parietal layer of the tunica vaginalis of testis



Fig 17: Conventional Hydrocelectomy: Hydrocele Sac Isolated and delivered out of scrotum totally

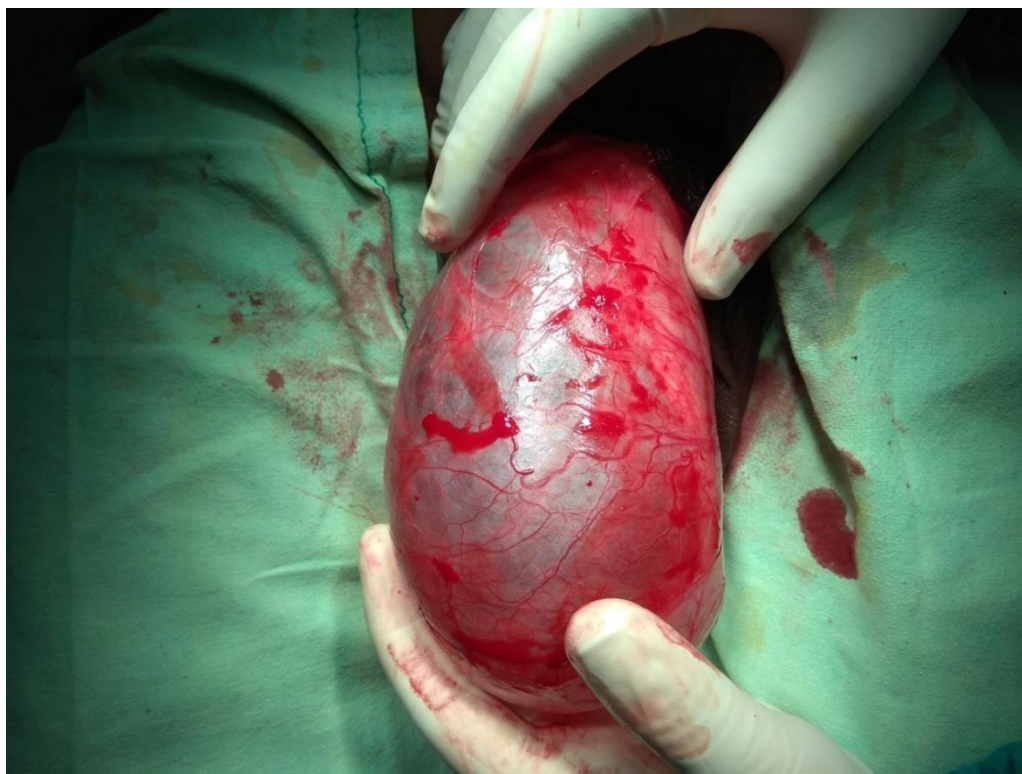


Fig 18: Conventional Hydrocelectomy: Fluid is evacuated using trocar and cannula. Sac is opened.

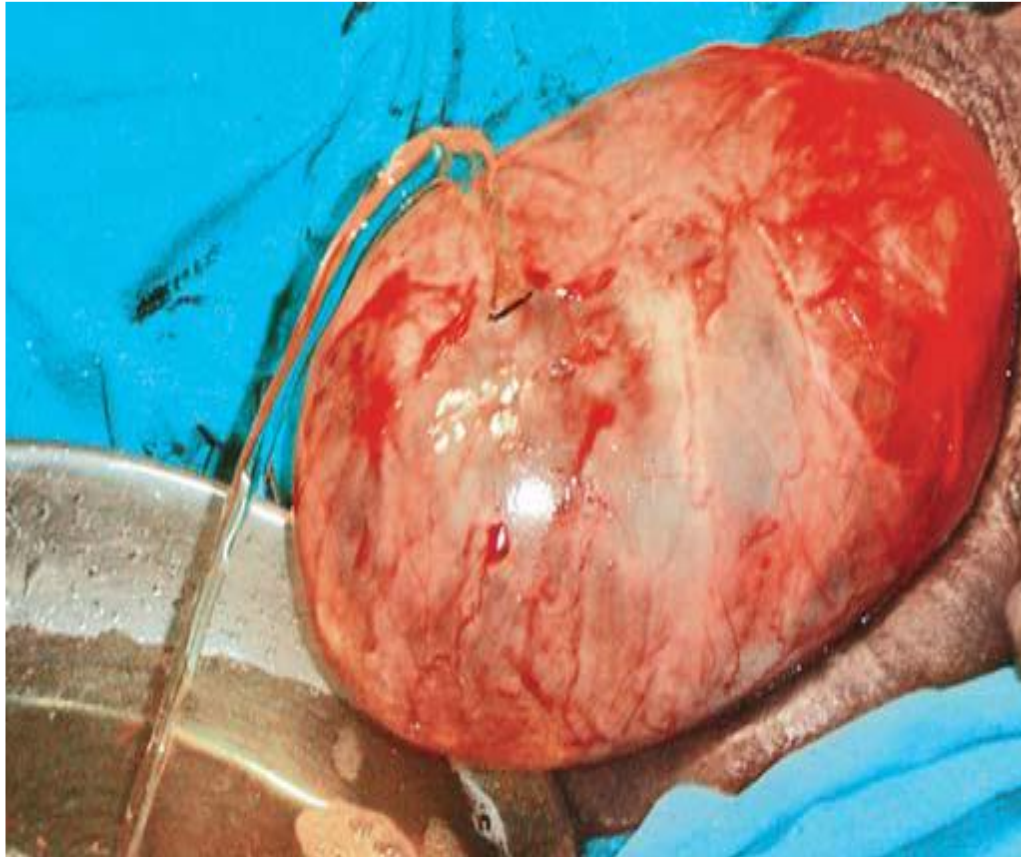


Fig 19: Conventional Hydrocelectomy: Evacuation and eversion of the sac behind the testis



Testis replace into the scrotal sac lateral sulcus facing laterally a drain is placed near the root of the scrotum on the lateral aspect because it becomes the most dependent portion, when scrotal support is given. Scrotal support is given to reduce the scrotal oedema.

- Wound is closed in layers.
- Drain is removed in 48 hours

Minimal Separation Hydrocelectomy

A small scrotal incision of about 2cm long was made and incision of the Dartos muscles in the same line was made using with electrocautery. The parietal tunica vaginalis (PTV) was identified grasped and minimal blunt dissection was made by the help of the index finger.

A small hole was made for the aspiration of hydrocele fluid. Then a disc of tissue was excised of the parietal tunica vaginalis about double of the skin incision dimension using electrocautery.

The edge of the visceral surface of the tunica vaginalis was sutured to the parietal layer of the tunica vaginalis and then to the Dartos muscle and all was sutured to scrotal skin in an everted manner aim to expose the visceral tunica toward scrotal skin. If the visceral surface of the tunica vaginalis is sutured to the Dartos, eversion will be created. Then when this everted structure is sutured to the scrotal skin, it will be in contact the sac with lymph-rich subcutaneous tissues.

A drain was kept in place and discharge was allowed for one day. Patients were followed up on second day for scrotal edema and hematoma and the drain was removed on same day.

Fig 20: Minimal Separation Hydrocelectomy: length of the scrotal skin incision about 2cm in size



Fig 21: Minimal Separation Hydrocelectomy: evacuation of hydrocele fluid through a small hole made over the tunica vaginalis.



Fig 22: Minimal Separation Hydrocelectomy: In hydrocele sac disc of tissue was excised about double of the skin incision dimension using electrocautery.

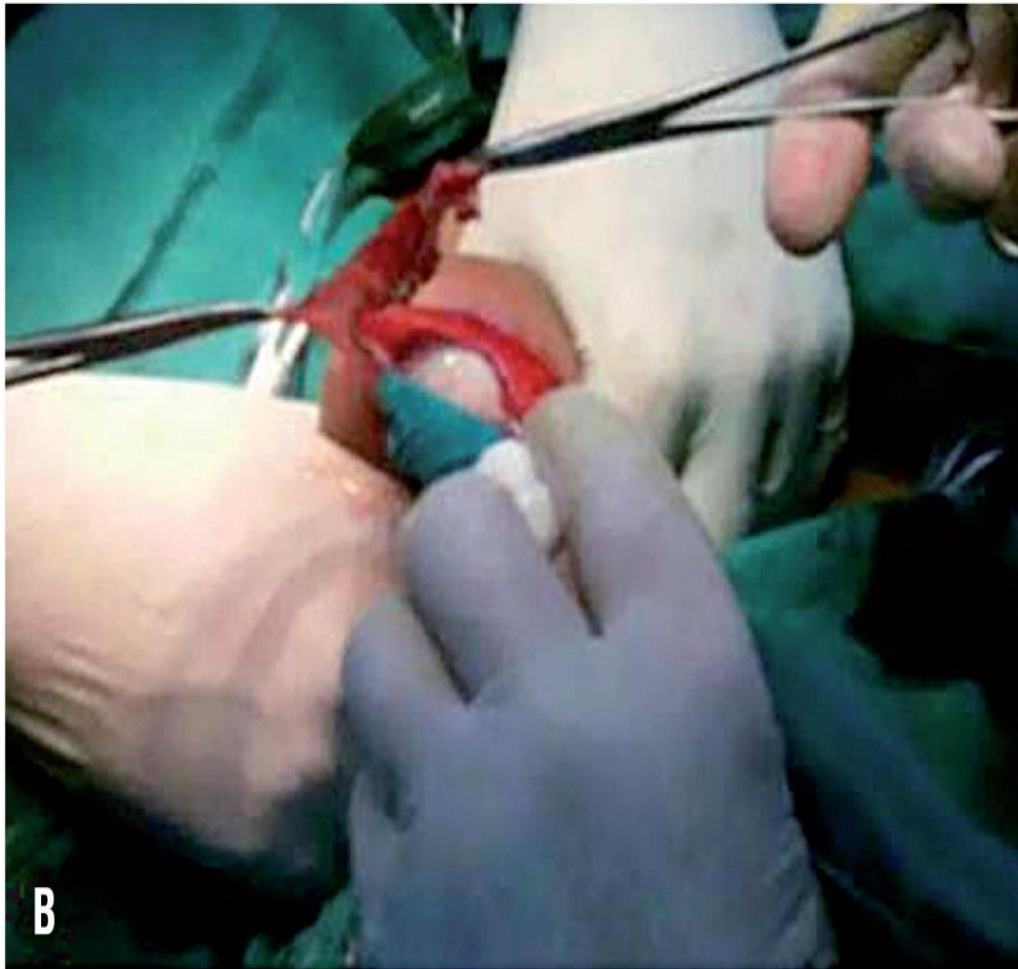
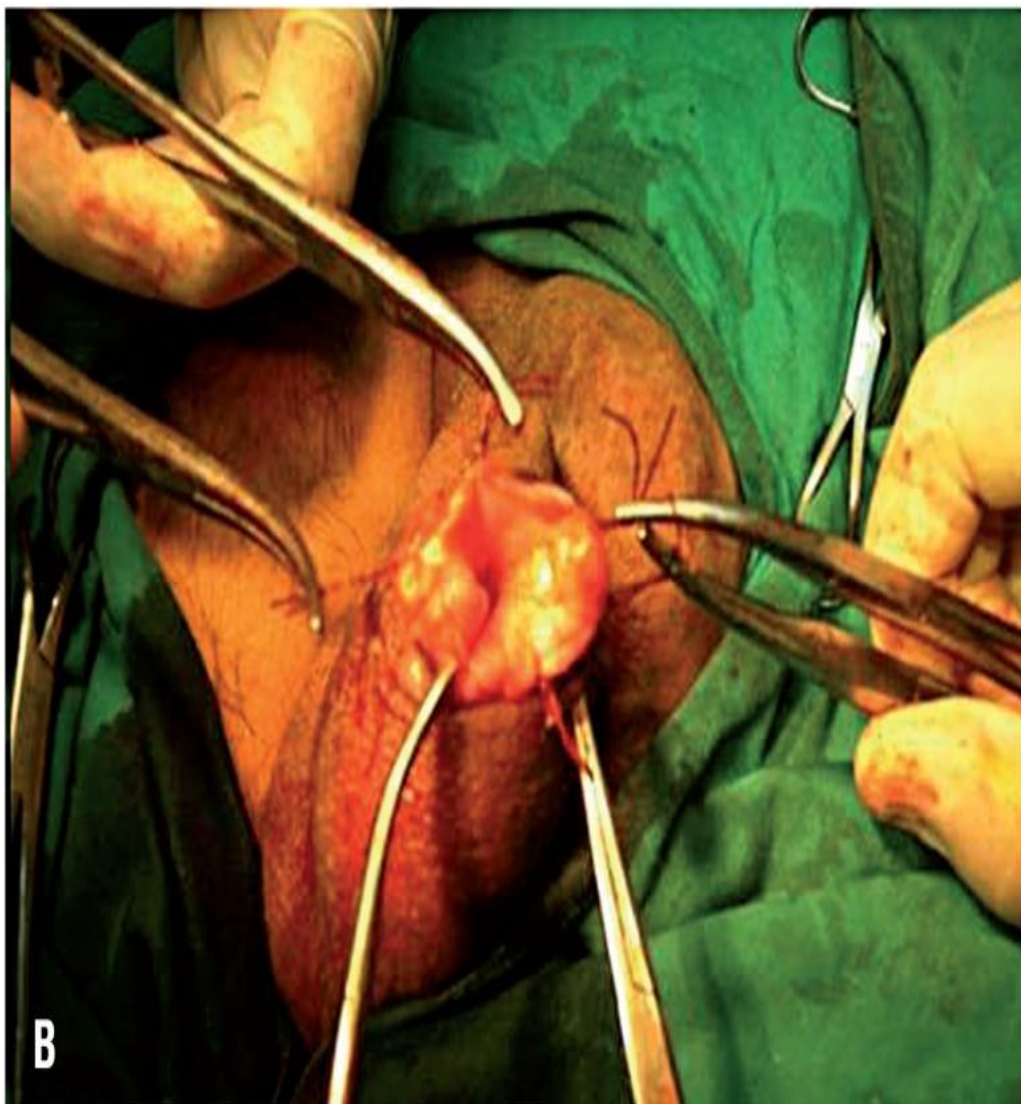


Fig 23: Minimal Separation Hydrocelectomy: Completed eversion technique by suturing the edge of the tunica vaginalis to Dartos and scrotal skin in an everted manner aiming to expose the visceral tunica toward scrotal sac



Study Tool

A questionnaire was designed which contained the details of patient's name, age, sex, symptoms or presenting complaints, duration of the swelling, site of the swelling, operating time in minutes, post-operative complications if any and duration of the hospital stay in hours.

Data Collection and Methods

- a. Data collection was done in the study area after obtaining prior permission from the Professor & HOD, Department of Surgery and The Dean, Kilpauk Medical College and approval of Institutional Ethical Committee.
- b. Each participant was given a brief introduction about the study and informed consent was obtained from all participants.
- c. The information about the study was explained to the patient in the local language clearly till they understood.

Services rendered

Each participant was assessed and provided treatment for the clinical condition by either of the two surgical techniques at free of cost. The patients were followed-up for up to 6 months for complications and if any noted, treatment and care were provided according to the needs.

ANALYSIS OF OBSERVATIONAL DATA

Data Entry

The data collected from the questionnaires were entered in Microsoft Excel 2013 version and the master chart was framed. The data entered were double checked for any errors. The data from the master chart were exported to Statistical Package for Software Solutions (SPSS) version 21 for analysis. Totally data was collected from 60 patients with 30 from each arm.

Data Analysis

Continuous variables were presented in the form of descriptive statistics (mean and standard deviation) and categorical variables in the form of frequency distributions and percentages. Association between categorical variables are tested using Chi square tests and Fisher exact tests. Association between continuous variables and a grouping variable were tested using student 't' test.

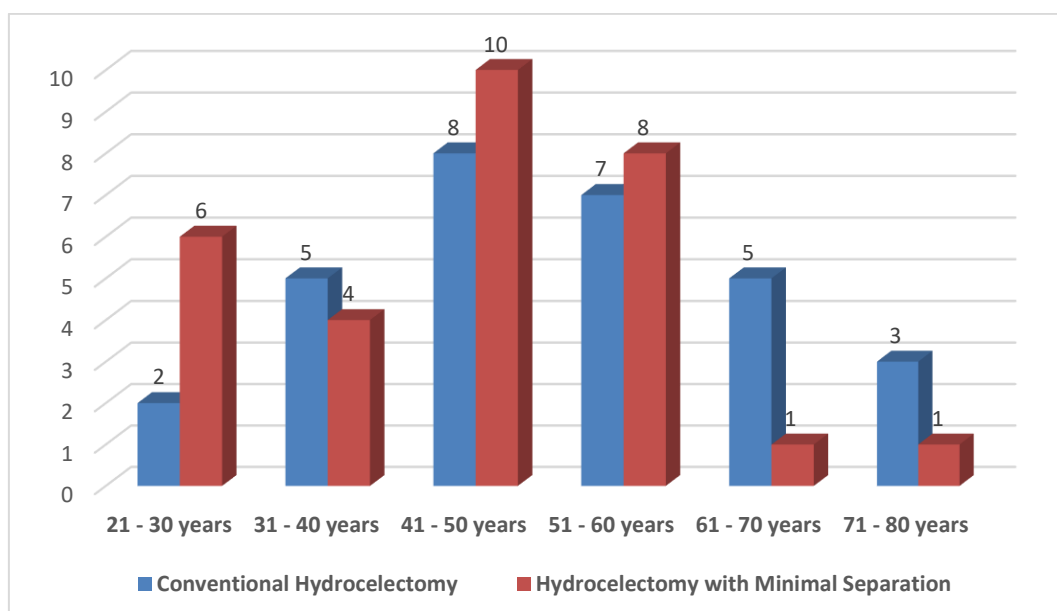
Data presentation

The distribution of categorical data in the total study & among rural and urban population were represented by tables and bar charts. The continuous variables distribution were depicted by tables, box plot and error bar chart. The distribution of continuous variables along a grouping variable with a linear trend is represented by line diagrams.

RESULTS

Considering the baseline characteristics, there was no significant difference between the two groups.

Fig 24 : Distribution of age categories in conventional and minimal separation hydrocelectomy groups.



The distribution of participants in the both groups of the study population in different age categories was almost nearly equal with no much difference.

Table 1: Distribution of age categories of the subjects in the two groups of the study population

AGE_CAT	PROCEDURE		Total	Fisher exact p value
	Conventional Hydrocelectomy	Hydrocelectomy with Minimal Separation		
21 - 30 years	2 (25%)	6 (75%)	8 (100%)	0.332
31 - 40 years	5 (55.55%)	4 (44.44%)	9 (100%)	
41 - 50 years	8 (44.44%)	10 (55.55%)	18 (100%)	
51 - 60 years	7 (46.66%)	8 (53.33%)	15 (100%)	
61 - 70 years	5 (83.33%)	1 (16.66%)	6 (100%)	
71 – 80 years	3 (75%)	1 (25%)	4 (100%)	

The difference in the distribution of study participants in the both groups was statistically insignificant.

Table 2: Distribution of symptoms of the participants in the two groups of the study population

SYMPTOMS	PROCEDURE		Total	Fisher exact p value
	Conventional Hydrocelectomy	Hydrocelectomy with Minimal Separation		
Painless scrotal swelling Left	7 (46.66%)	8 (53.33%)	15 (100%)	0.096
Painless scrotal swelling Right	14 (50%)	14 (50%)	28 (100%)	
Discomfort with scrotal swelling Left	4 (50%)	4 (50%)	8 (100%)	
Discomfort with bilateral scrotal swelling	5 (55.55%)	4 (44.44%)	9 (100%)	
Total	30 (50%)	30 (50%)	60 (100%)	

The presentation of symptoms of the patients is almost equal in both groups of the study population and the difference in the distribution is statistically insignificant.

Table 3: Distribution of presentation of side of hydrocele of the participants in the two groups of the study population

SIDE	PROCEDURE		Total	Fisher exact p value
	Conventional Hydrocelectomy	Hydrocelectomy with Minimal Separation		
Left	12 (50%)	12 (50%)	24 (100%)	0.143
Right	13 (48.14%)	14 (51.85%)	27 (100%)	
Bilateral	5 (55.55%)	4 (44.44%)	9 (100%)	
Total	30 (50%)	30 (50%)	60 (100%)	

The presentation of side of hydrocele of patients in the both groups had no much difference with right side more common followed by left side and a few by both sides. The difference in the distribution is statistically insignificant.

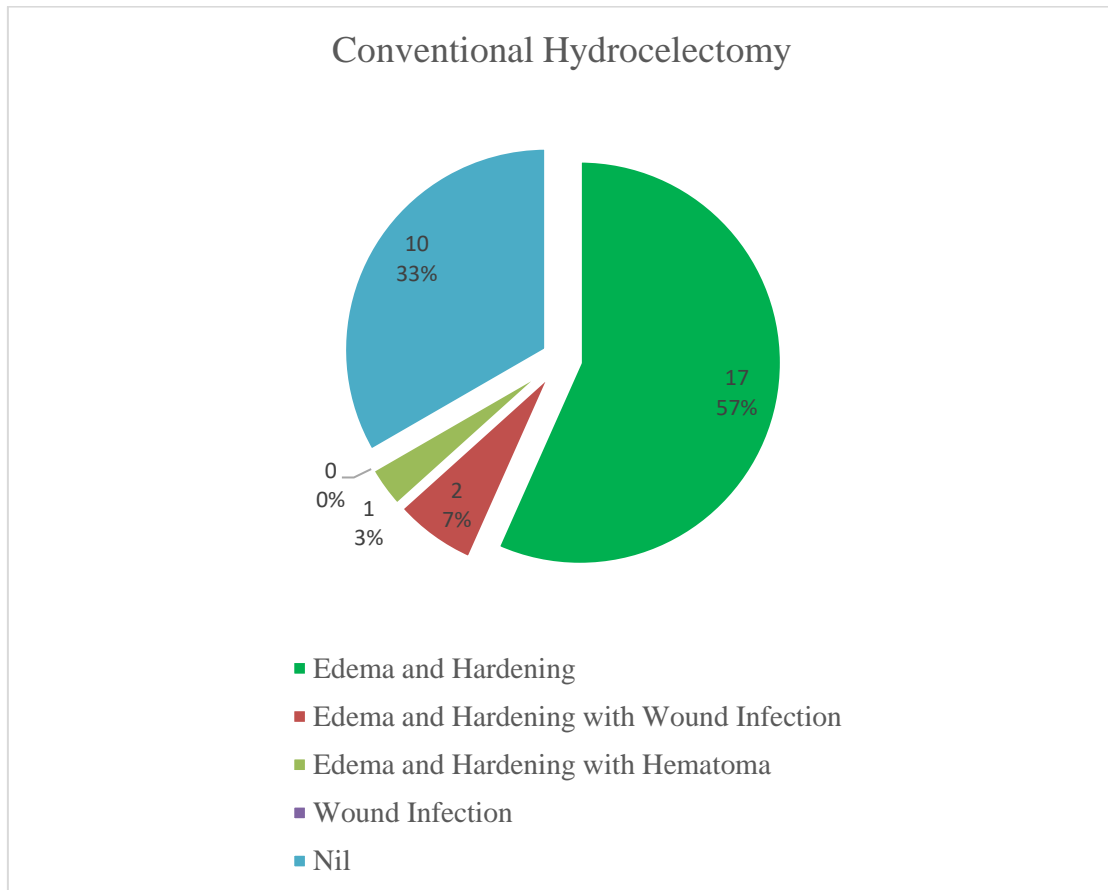
Table 4: Distribution of duration of hydrocele (in years) of the participants in the two groups of the study population

Variable	GROUP	N	Mean	Std. Deviation	p value by 't' test
DURATION OF HYDROCELE (Years)	Conventional Hydrocelectomy	30	7.57	4.08	0.356
	Hydrocelectomy with Minimal Separation	30	6.63	3.67	

Variable	Group	Minimum	Maximum	Range
DURATION OF HYDROCELE (Years)	Conventional Hydrocelectomy	1	17	16
	Hydrocelectomy with Minimal Separation	1	17	16

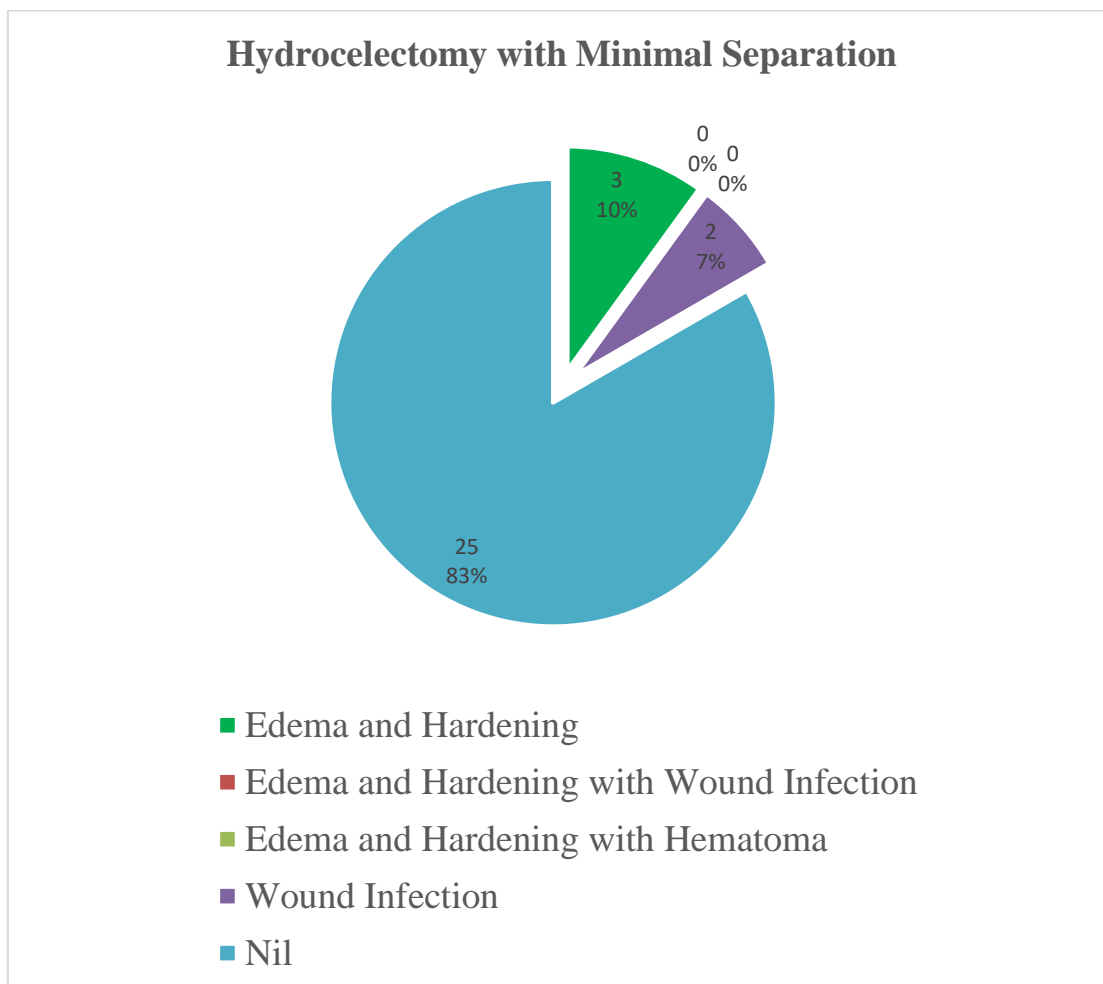
The mean duration of hydrocele of patients in the both groups of the study population had only a mild difference which was not statistically significant. The range of duration of hydrocele was 16 years (1 to 17 years) in both the study groups.

Fig 25: Percentage of Post-operative complications of the study subjects in the conventional hydrocelectomy group



93% of the patients presented with oedema and hardening out of which 33% also presented with wound infection and 3% also presented with hematoma. Only 7% had no post-operative complications.

Fig 26: Percentage of Post-operative complications of the study subjects in the minimal separation hydrocelectomy group



Only 10% of the study participants underwent minimal separation hydrocelectomy presented with oedema and hardening and only 7% presented with wound infection. 83% of the patients didn't experience any post-operative complications.

Table 5: Distribution of post-operative complications of the participants in the two groups of the study population

POSTOPCOMPL ICATIONS	PROCEDURE		Total	Fisher exact p value
	Conventional Hydrocelecto my	Hydrocelectomy with Minimal Separation		
Oedema and Hardening	17 (56.7%)	3 (10%)	20 (100%)	<0.001
Oedema and Hardening with Wound Infection	2 (6.7%)	0 (0%)	2 (100%)	0.246
Oedema and Hardening with Hematoma	1 (3.3%)	0 (0%)	1 (100%)	0.500
Wound Infection	0 (0%)	2 (6.7%)	2 (100%)	0.246

Edema and hardening was the most common complication and is more incident in patients who underwent conventional hydrocelectomy. The difference in the distribution of edema and hardening among the patients in the two study groups was statistically significant.

Table 6: Distribution of overall post-operative complications of the participants in the two groups of the study population

OVERALL POST-OPERATIVE COMPLICATIONS	PROCEDURE		Fisher exact p value
	Conventional Hydrocelectomy	Hydrocelectomy with Minimal Separation	
YES	20 (66.7%)	5 (16.7%)	<0.001
NO	10 (33.3%)	25 (83.3%)	

Taking into account, the overall post-operative complications suffered by the patients in both groups of the study population, the conventional hydrocelectomy group had more incidence of post-operative complications. Around 67% of the patients belonged to conventional hydrocelectomy group of the study population suffered complications whereas only 17% of the patients belonged to minimal separation hydrocelectomy group suffered complications.

Table 7: Distribution of operating time of the patients in the two groups of the study population

	GROUP	N	MEAN	STD. DEVIATION	p VALUE BY 't' TEST
OPERATING TIME (Min)	Conventional Hydrocelectomy	30	30.83	2.94	0.0001
	Hydrocelectomy with Minimal Separation	30	17.93	1.28	

Variable	GROUP	Minimum	Maximum	Range
OPERATING TIME (Min)	Conventional Hydrocelectomy	25	35	10
	Hydrocelectomy with Minimal Separation	15	20	5

The difference in the distribution of operative time of the patients underwent two different surgical procedures were statistically significant with higher mean operating time in conventional hydrocelectomy than minimal separation hydrocelectomy.

Table 8: Distribution of time of hospital stay (in hours) of the patients in the two groups of the study population

Variable	GROUP	N	MEAN	STD. DEVIATION	p VALUE BY 't' TEST
HOSPITAL STAY (Hours)	Conventional Hydrocelectomy	30	80.50	13.45	0.0001
	Hydrocelectomy with Minimal Separation	30	48.57	21.19	

Variable	GROUP	Minimum	Maximum	Range
HOSPITAL STAY (Hours)	Conventional Hydrocelectomy	48	98	50
	Hydrocelectomy with Minimal Separation	25	95	70

The difference in the distribution of time of hospital stay of the patients underwent two different surgical procedures was statistically significant with higher mean time of hospital stay in conventional hydrocelectomy than minimal separation hydrocelectomy.

DISCUSSION

The mean age of the participants in the study population was 47.7 ± 14.15 years with a minimum of 21 years to a maximum of 80 years. This age distribution was almost close to the Saber study which was included participants from 18 to 56 years with a mean of 37 ± 11.4 years.

The mean operating time among those patients who underwent conventional hydrocelectomy was 30.83 ± 2.9 minutes with the range of 25 to 35 minutes and those who underwent the Minimal separation hydrocelectomy was 17.93 ± 1.28 minutes with a range of 15 to 20 minutes. The difference in the mean time between the two surgical procedures was statistically significant ($p < 0.01$).

Similarly in Saber study, the operating time for conventional hydrocelectomy was slightly higher with mean of 32.5 ± 4.76 minutes upto a maximum of 40 minutes and the operating time for minimal access hydrocelectomy was slightly lower with mean of 15.1 ± 4.24 minutes with a range of 12 to 18 minutes. The difference in mean operating time between the two procedures was statistically significant ($p < 0.02$).

The mean time of hospital stay among the patients who underwent conventional hydrocelectomy was 80.5 ± 13.45 hours with a range of 48

to 98 hours and those who underwent Minimal access hydrocelectomy was 48.57 ± 21.19 hours with a range of 25 to 95 hours.

The difference in the mean time between the two surgical procedures was statistically significant ($p < 0.01$). In Saber study, the mean time of hospital stay for conventional hydrocelectomy was lower with mean of 21.19 ± 11.65 hours with a range of 12 to 48 hours and the mean time of hospital stay for minimal access hydrocelectomy was lower with mean of 13.48 ± 6.38 hours with a range of 10 to 30 hours. But the difference in the above mean time of hospital stay between two procedures was not statistically significant ($p > 0.05$). This could be attributed to the geographical differences in the protocol management of the cases in the hospital. The differences may be due to available resources and sufficient health care providers.

The overall complication rate (percentage of patients experienced any complication) among the patients underwent conventional hydrocelectomy was 66.6% whereas it was very low among patients underwent minimal separation hydrocelectomy of 16.6% and the difference in this distribution was statistically significant ($p < 0.001$). The low complication rate among the minimal separation group was supported by the Saber study which states an overall complication rate

among patients underwent minimal access hydrocelectomy was 12.7% and also showed a statistically significant difference from the complication rate among patients underwent conventional hydrocelectomy (37%).

The most common complication of the patients undergoing hydrocelectomy is edema and hardening. In the present study, 57% of the patients who underwent conventional hydrocelectomy suffered from edema and hardening over the surgical site post-operatively compared to 10% incidence in the patients who underwent minimal separation hydrocelectomy.

This difference in the distribution was also statistically significant. This is additive to the evidence produced by Saber study which also showed a significant difference in the distribution of edema and hardening among the patients between conventional hydrocelectomy (25%) and minimal access hydrocelectomy (5%). The next common complication following hydrocelectomy is hematoma over the surgical site. Only 3% of the patients who underwent conventional hydrocelectomy had incidence of hematoma whereas there was no incidence of hematoma in patients underwent minimal separation

hydrocelectomy. In the Saber study also there was zero incidence of the hematoma in patients who underwent minimal access hydrocelectomy.

Oedema and hematoma are the most common in excision and eversion technique (conventional hydrocelectomy). This is because of wide dissection and excessive handling of the hydrocele sac during the surgery. In the minimal separation hydrocelectomy a disc of the hydrocele sac is pulled and resected through a small scrotal incision with minimal dissection. The other complications following hydrocelectomy are wound infection which is very negligent among both groups of patients.

Fig 27. Left side 3rd post-operative day



Left side 3rd post-operative day picture shows healthy wound with no scrotal edema in minimal separation hydrocelectomy...right side shows scrotal edema with discomfort felt by the patient in conventional hydrocelectomy....

Fig 28: 3rd post-operative day picture shows healthy wound



post-operative day picture shows healthy wound with no scrotal edema

in minimal separation hydrocelectomy

LIMITATIONS

Due to availability of limited resources, the trial was single blinded and so there would have been a few chances of interviewer bias. If the study was done double or triple blinded, the results would have been much better.

Due to availability of limited resources, the patients were followed up for only up to the post-operative period of hospital stay only. So that long term complications could not be evaluated.

CONCLUSION

1. The overall complication rate among patients underwent minimal access hydrocelectomy (17%) is very less compared to conventional hydrocelectomy (67%).
2. The operating time of hydrocelectomy was around 13 minutes significantly lesser in minimal access hydrocelectomy (17.93 ± 1.28 minutes) compared to conventional hydrocelectomy (30.83 ± 2.9 minutes).
3. The patients underwent minimal access hydrocelectomy (48.57 ± 21.19 hours) had a significantly lesser hospital stay of around 32 hours compared to conventional hydrocelectomy (80.5 ± 13.45 hours).

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APPENDIX I - PROFORMA

Questionnaire:

- Name :
- Age :
- Sex :
- IP No :
- Date of admission :
- Date of surgery :
- Date of discharge :
- Address :
- Phone number :
- Co-morbid illness(DM, TB, HT, BRONCHIAL ASTHMA, SEIZURE):
- Elective/ Emergency :
- Diagnosis :
- Procedure done :
- Duration of surgery :

Post-operative complaints if any:-

- At 3rd, 5th post-operative day, do you have any increased swelling in the operative site?
- Do you have fever?
-
- Do you have persistent pain in the operative site?
- Do you have any discharge from the operative site?
- Do you have any discomfort in doing your daily activities?
- Do you find any difference in those symptoms during 1st, 3rd and 6th month?
- Are you satisfied with this procedure done.

APPENDIX III–MASTER CHART

A	B	C	D	E	F	G	H	I	J	K	L
1						Conventional Hydrocelectomy (Jaboulay's Procedure)					
2											
S.NO	NAME	AGE	SEX	IP NO.	SYMPTOMS	DURAT ION OF HYDR OCELE (In	SIDE	PROCEDURE	POST OP COMPLICATION S	OPERATIN G TIME (In Min)	HOSPITAL STAY (In Hours)
3											
4	PONDURANGAN	55	M	51829	Painless swelling scrotum Left	6	Left	conventional hydrocelectomy	Nil	31	48
5	SUBASH	64	M	70105	Right sided scrotal swelling	10	Right	conventional hydrocelectomy	edema&hardening Wound Infection	28	98
6	GOPI	41	M	13847	Right sided scrotal swelling	1	Right	conventional hydrocelectomy	Nil	25	58
7	RAMASAMY	34	M	13870	Discomfort and left sided scrotal swelling	8	Left	conventional hydrocelectomy	edema&hardening	30	89
8	MANI	60	M	41861	Painless swelling scrotum Left	8	Left	conventional hydrocelectomy	edema&hardening Hematoma	29	93
9	ARUL PRAKASH	45	M	16374	Discomfort and right & left scrotal swelling	4	Bilateral	conventional hydrocelectomy	Nil	32	64
10	KASINATHAN	80	M	20900	Right sided scrotal swelling	8	Right	conventional hydrocelectomy	edema&hardening	28	98
11	SWAMINATHAN	80	M	23113	Right sided scrotal swelling	11	Right	conventional hydrocelectomy	edema&hardening	31	98
12	SHIVA	55	M	23845	Discomfort and right & left scrotal swelling	5	Bilateral	conventional hydrocelectomy	edema&hardening	33	96
13	GANESHAN	50	M	27439	Right sided scrotal swelling	17	Right	conventional hydrocelectomy	Nil	25	62
14	GANAPATHY	40	M	37477	Right sided scrotal swelling	9	Right	conventional hydrocelectomy	edema&hardening	33	91
15	CHINASWAMY	62	M	28498	Discomfort and right & left scrotal swelling	15	Bilateral	conventional hydrocelectomy	edema&hardening	35	82
16	DEVARAJ	32	M	14185	painless right sided scrotal swelling	9	Right	conventional hydrocelectomy	edema&hardening	29	97
17	RAMAMOORTHY	55	M	35026	Painless swelling scrotum Left	8	Left	conventional hydrocelectomy	edema&hardening	31	86
18	VELAVAN	46	M	14253	Painless swelling scrotum Left	7	Left	conventional hydrocelectomy	edema&hardening	32	79
19	GOPAL	48	M	7829	Painless swelling scrotum Left	8	Left	conventional hydrocelectomy	edema&hardening	34	80
20	MUTHUKRISHNAN	44	M	13545	Right sided scrotal swelling	10	Right	conventional hydrocelectomy	Nil	26	74
21	KALYANINATHAN	38	M	13584	Right sided scrotal swelling	8	Right	conventional hydrocelectomy	edema&hardening	35	78
22	BHARAMIDHASAN	44	M	13800	Right sided scrotal swelling	5	Right	conventional hydrocelectomy	edema&hardening	32	83
23	KAMALAKUMAR	55	M	14329	Painless swelling scrotum Left	7	Left	conventional hydrocelectomy	Nil	28	70
24	SUNILKUMAR	69	M	6917	Discomfort and right & left scrotal swelling	2	Bilateral	conventional hydrocelectomy	Nil	31	71
25	IRUDAYARAJ	62	M	18514	light sided scrotal swelling	3	Left	conventional hydrocelectomy	edema&hardening	33	84
26	RAJENDRAN	51	M	20059	Discomfort and left sided scrotal swelling	1	Left	conventional hydrocelectomy	edema&hardening	35	62
27	DEVAN	53	M	196251	Discomfort and left sided scrotal swelling	4	Left	conventional hydrocelectomy	edema&hardening	29	88
28	KUMAR	41	M	12869	Painless swelling scrotum Left	17	Left	conventional hydrocelectomy	edema&hardening Wound Infection	34	95
29	SURESHKUMAR	30	M	30487	Right sided scrotal swelling	9	Right	conventional hydrocelectomy	Nil	33	62
30	SARATHI	23	M	30960	Right sided scrotal swelling	8	Right	conventional hydrocelectomy	edema&hardening	35	85
31	KALIBAI	32	M	20900	Right sided scrotal swelling	11	Right	conventional hydrocelectomy	edema&hardening	29	80
32	MANIKAM	73	M	31002	Discomfort and left sided scrotal swelling	5	Left	conventional hydrocelectomy	edema&hardening	28	85
33	RATHANASWAMY	70	M	31397	Discomfort and right & left scrotal swelling	3	Bilateral	conventional hydrocelectomy	edema&hardening	31	79

Hydrocelectomy with Minimal Separation											
S.NO	NAME	AGE	SEX	IP NO.	SYMPTOMS	DURATION OF HYDROCELE (In)	SIDE	PROCEDURE	POST OP COMPLICATION	OPERATING TIME (In Min)	HOSPITAL STAY (In Hours)
39											
40											
41											
42											
43	1 KRISHNAN	24	M	17056	Right sided scrotal swelling	9	Right	Hydrocelectomy with Minimal	Nil	18	48
44	2 SUBRAMANI	55	M	27974	left sided scrotal swelling	8	Left	Hydrocelectomy with Minimal	Nil	17	44
45	3 IBRAHIM	48	M	28482	left sided scrotal swelling	7	Left	Hydrocelectomy with Minimal	Wound Infection	18	91
46	4 ELUMALAI	51	M	35232	Right sided scrotal swelling	8	Right	Hydrocelectomy with Minimal	Nil	19	45
47	5 AMANDHA BABU	29	M	36399	Painless swelling scrotum Left	9	Left	Hydrocelectomy with Minimal	Nil	17	37
48	6 VEERAPANDYAN	35	M	64920	Discomfort and right & left scrotal swelling	8	Bilateral	Hydrocelectomy with Minimal	Nil	19	28
49	7 VENKATESAN	50	M	37791	left sided scrotal swelling	7	Left	Hydrocelectomy with Minimal	Nil	20	44
50	8 PALANI	67	M	38031	Right sided scrotal swelling	5	Right	Hydrocelectomy with Minimal	Wound Infection	19	95
51	9 LALUKHAN	55	M	12352	Right sided scrotal swelling	7	Right	Hydrocelectomy with Minimal	Nil	16	44
52	10 MAMI	55	M	36254	Discomfort and left sided scrotal swelling	17	Left	Hydrocelectomy with Minimal	Nil	18	47
53	11 RAJESH	45	M	36324	Right sided scrotal swelling	9	Right	Hydrocelectomy with Minimal	Nil	18	48
54	12 MARIMUTHU	40	M	32416	Right sided scrotal swelling	15	Right	Hydrocelectomy with Minimal	Nil	16	54
55	13 VENU	55	M	36228	Right sided scrotal swelling	9	Right	Hydrocelectomy with Minimal	Nil	18	28
56	14 MANDHARAN	51	M	36296	Painless swelling scrotum Left	8	Left	Hydrocelectomy with Minimal	Nil	15	31
57	15 SASIKUMAR	21	M	36381	Painless swelling scrotum Left	7	Left	Hydrocelectomy with Minimal	edema&hardening	18	92
58	16 YASUDEYAN	76	M	30709	Discomfort and right & left scrotal swelling	8	Bilateral	Hydrocelectomy with Minimal	Nil	19	37
59	17 JOHN PETER	46	M	30735	Right sided scrotal swelling	10	Right	Hydrocelectomy with Minimal	Nil	20	25
60	18 MUTHURAMLIGAM	55	M	30800	Right sided scrotal swelling	8	Right	Hydrocelectomy with Minimal	Nil	18	49
61	19 SATHESH KUMAR	29	M	25691	Right sided scrotal swelling	5	Right	Hydrocelectomy with Minimal	Nil	19	52
62	20 MURUGAN	46	M	28032	Discomfort and left sided scrotal swelling	7	Left	Hydrocelectomy with Minimal	edema&hardening	19	88
63	21 THARANI ANSARI	42	M	37656	Discomfort and right & left scrotal swelling	2	Bilateral	Hydrocelectomy with Minimal	Nil	17	27
64	22 NAGARAJ	40	M	37529	Painless swelling scrotum Left	3	Left	Hydrocelectomy with Minimal	Nil	16	55
65	23 BASKARAN	42	M	37586	Discomfort and left sided scrotal swelling	1	Left	Hydrocelectomy with Minimal	Nil	18	30
66	24 INDHARAJITH	35	M	37212	Painless swelling scrotum Left	4	Left	Hydrocelectomy with Minimal	Nil	19	29
67	25 NITYAMANDAN	22	M	29593	Right sided scrotal swelling	5	Right	Hydrocelectomy with Minimal	edema&hardening	20	89
68	26 CHARLES	43	M	29652	Right sided scrotal swelling	2	Right	Hydrocelectomy with Minimal	Nil	16	48
69	27 SASIDHARAN	58	M	28623	Right sided scrotal swelling	3	Right	Hydrocelectomy with Minimal	Nil	18	49
70	28 KUMARASAN	47	M	38025	Right sided scrotal swelling	1	Right	Hydrocelectomy with Minimal	Nil	18	37
71	29 KATHIRAVAN	28	M	62902	Painless swelling scrotum Left	4	Left	Hydrocelectomy with Minimal	Nil	18	29
72	30 RAVI	42	M	55955	Discomfort and right & left scrotal swelling	3	Bilateral	Hydrocelectomy with Minimal	Nil	17	37