

Preoperative Paralysis of Abdominal Musculature using Botox and Progressive Pneumoperitoneum - An Alternate Approach for Giant Inguinal Hernia Repair

Dr D Ramesh¹, Dr Maliha Yasmeen², Dr Chikkudu Yashwanth³, Dr Saroj Noel Kappala⁴

¹Osmania General Hospital, Hyderabad, Telangana, India

²Osmania General Hospital, Hyderabad, Telangana, India
Email: yasmeen.maliha[at]yahoo.com

³Osmania General Hospital, Hyderabad, Telangana, India
Email: Yashu.chikkudu[at]gmail.com

⁴Osmania General Hospital, Hyderabad, Telangana, India
Email: Ksnoel96[at]gmail.com

Abstract: Giant hernias are uncommon and rarely encountered hence there are no clear guidelines on the management of such cases. However, Giant Inguinal Hernias (GIH) are mostly asymptomatic apart from the obvious swelling in the inguinoscrotal region. Sometimes, they might have skin excoriation, urinary disturbances due to the penis being buried completely thereby obstructing the urethral meatus. Operating such patients with GIH does pose a significant risk of postop abdominal compartment syndrome due to intra-abdominal hypertension leading upto death. It is advisable to prepare such patients pre-operatively in order to mitigate such dreaded complications. The combined efforts of a Multi-Disciplinary Team consisting of a General Surgeon, Urologist, Interventional Radiologist, Anesthetist may prove beneficial to reduce the morbidity associated. Steps taken to increase the abdominal cavity volume in order to accommodate the herniated contents include Preoperative Progressive Pneumoperitoneum (PPP), weakening/ temporarily paralyzing the abdominal muscles, resection of herniated contents, splenectomy, omentectomy, etc. We present a case of a 63-year-old male chef of lower economic strata residing in Gowliguda, Hyderabad. The patient presented with a large inguinoscrotal swelling in the right groin region with mild dragging type of pain. He has no significant comorbidities. On preop CT, Tanaka Index was measured to be 55%, i.e loss of domain hernia. We planned to infiltrate botulinum toxin into the lateral abdominal muscles initially followed by progressive pneumoperitoneum and then later perform hernioplasty, with an interval of 15 days between each procedure. The toxin would serve to paralyze the muscles in order for the abdomen to accommodate the hernial contents. After 15 days, the abdomen was insufflated with air of 750cc daily for the next 2 weeks. CT Abdomen at this point revealed the decrease in Tanaka index to 55%. The patient then underwent Lichtenstein tension free meshplasty, following which he was discharged with a Tanaka index score was 20% with an uneventful postoperative period.

Keywords: Hernia, Botulinum Toxin, Pneumoperitoneum, Compartment Syndrome

1. Introduction

Giant Inguinal Hernias are defined as hernias that extend up to the midpoint of the thigh in standing position or if they exhibit an anteroposterior diameter of 30cms or latero lateral diameter of 50cms. The key point in their management is ensuring the abdomen is able to withstand the increased pressure and volume following the reintroduction of the scrotal contents. Hence, we present such a case in which we used Injection Botulinum Toxin to sufficiently relax and stretch the abdominal musculature to accommodate the hernial contents and thereby decrease the chance of intraabdominal hypertension and compartment syndrome.

2. Case Details

We present a case of a 63-year-old male patient presented with a swelling in the right inguinoscrotal region since 20 years. Initially the swelling was small, of approximately 3x4cm, then it progressed gradually to the current size of 30x40cm with extent up to mid-thigh. The swelling was irreducible and associated with dragging pain. He had had Left sided Hernioplasty for similar complaints on the opposite side.



Figure 1: Patient in standing position

Volume 13 Issue 3, March 2024

Fully Refereed | Open Access | Double Blind Peer Reviewed Journal

www.ijsr.net

On examination after taking informed consent, the patient is conscious, coherent and well oriented to time, place and person. He is adequately built and well nourished. His vitals were within normal limits.

Patient was examined in both supine and standing positions. A single, pyriform swelling of 30x40cm was noted in the right inguinoscrotal region extending from right groin to mid-thigh. The swelling had smooth surface, and well-defined margins with no visible or palpable cough impulse. Visible peristalsis was noted over the swelling.

Table 1: Dimensions Of Swelling

Vertical	38cm
Midline to right	20cm
Midline to left	8cm
Horizontal	30cm
Penis to base	20cm

The penis was found to be buried. Bilateral testes were not palpable.

A scar was noted over the left inguinal region.

On percussion, a dull note was heard over the swelling. On auscultation, normal bowel sounds were noted.

Per Rectal Examination was found to be essentially normal.

3. Management

3.1 Preoperative Workup

As part of our preoperative workup, we had ordered a routine surgical profile. CT abdomen and Pelvis Scan was performed in order to calculate Tanaka score which in turn would allow us to calculate loss of domain. Loss of domain predicts the amount viscera which can be reintroduced into the abdomen without hampering the respiratory and other systemic functions.

Surgical Profile:

Table 2: Blood Parameters

Parameter	09/11/23	21/11/23	Preop
Hemoglobin (%)	11.2	12.7	12.4
TLC (cumm)	6700	5700	6900
Platelets	2.3	2.7	2.7
Blood Urea	27	27	27
Serum Creatinine	0.7	0.8	0.6
Serum Sodium	132	141	135
Serum Potassium	4	4.4	4.5
Serum Total Proteins			6.7
Serum Albumin			3.6
INR			1.6

CHEST XRAY – NAD

2D ECHO – EF 60%

No RWMA

Good RV function

No PE/clot/vegetation

Ultrasound Abdomen & Pelvis:

e/o a Large defect noted in anterior abdominal wall in right inguinal region with herniation of small bowel, large bowel and omentum along with mesenteric vessels noted.

Bowel showing normal caliber normal peristalsis and normal vascularity

F/S/O: Right Non-Obstructive Inguinal Hernia

Grade II fatty liver

CT ABDOMEN AND PELVIS

E/o 6 cm defect noted in right inguinal region with herniation of omentum and bowel with mesentery.

Herniated bowel loops appear normal in caliber.

No free fluid noted in hernial sac.

Loss of domain hernia noted.

Tanaka Index of 0.66.

Loss of Domain:

This is defined as more than 25% of the abdom

Here we used Tanaka method to calculate loss of domain. This method uses Volume Ratio measurements on Abdominal CT.

The abdominal cavity volume was determined anteriorly by the line that united the muscle groups on either side of the hernia, posteriorly by a line passing through the transverse processes of the vertebrae, cranially by the first axial slice that shows the diaphragm, caudally by the last slice that shows the coccyx, and transversely by the parietal peritoneum of each side of the abdominal cavity.

For the hernia sac volume, the limits were the parietal peritoneum of the hernia sac in the cranial, caudal, transverse, and anterior limits. The posterior limit was determined by the same line as the anterior limit of the abdominal cavity.

Loss of Domain/Volume ratio is Ratio of hernial sac volume to abdominal cavity volume.

In our present case Loss of Domain or Tanaka index is

Intra-abdominal volume = 8102cc

Hernia sac volume. =5389cc

Tanaka index = $\frac{5389}{8102} = 0.66 = 66\%$

Based on the patient age, comorbidities, and investigations performed, we proposed a management plan in which Botulinum Toxin is injected in the lateral abdominal wall muscles followed by Preoperative progressive pneumoperitoneum (PPP) and thereby Hernioplasty after 1 month.

Botulinum toxin (BTX) injection into lateral abdominal muscles under ultrasound guidance

BTX is a neurotoxin that acts selectively on presynaptic cholinergic nerve terminals, blocking the release of

acetylcholine resulting in temporary flaccid muscle paralysis without systemic effects.

Applying this neurotoxin to the lateral muscle complex (External oblique, Internal oblique and Transversus Abdominus) can paralyze and subsequently elongate the muscle complex; facilitating medialization of the rectus muscles.

300 IU of Botox is infiltrated into three groups of lateral abdominal wall muscles.

Each vial contains 50 IU of Botox in powdered form and is diluted with 2.5 ml normal saline (NS) i.e. 300 IU is diluted in approximately 150ml NS.

25 ml is then injected in each site with 8 ml in each muscle approximately. Each vial costs 12,000 rupees with total cost being 72,000 rupees.



Figure 2: Injection site of Botulinum Toxin under ultrasound guidance



Figure 3: Ultrasound of abdominal muscles

Sites of injection:

- 1) Right and left subcostal region in mid clavicular line
- 2) Right and left lumbar regions in anterior axillary line
- 3) Right and left iliac regions in anterior axillary line.

Side effects of Botulinum Toxin A injection include weak cough, back pain, and superficial bruising at the site of injection.

However, in our case, we have not reported such side effects after injection.

Preoperative progressive pneumoperitoneum

This technique is done after 2 weeks of Botox infiltration.

It is defined as the technique of creating pneumoperitoneum by inserting a central line catheter or a Ryle's tube into the peritoneal cavity.

Thereafter, around 500 to 750 ml of air (as tolerated) is pushed into the peritoneal cavity every day.

This expands the abdominal cavity by stretching the paralyzed muscles.

A 5mm incision is given over the palmer's point and a 5mm camera port is inserted. Pneumoperitoneum is created by CO2 initially. Another 5mm port is inserted in left lumbar region. A 14 Fr Ryle's tube is inserted through this port and fixed to skin using the purse string technique.

Pneumoperitoneum insufflated by CO2 is removed and around 750ml of room air is pushed into the peritoneal cavity. After which we measure abdominal girth daily.



Figure 4: Insufflating air to create pneumoperitoneum

Table 3: Trend Of Abdominal Girth

Date	Air insufflated (cc)	Abdominal girth (cm)	Remarks
Preop		90	
POD 0	750	90	
POD 1	750	91	
POD 2	750	93	
POD 3	750	95	
POD 4	-	97	Patient developed subcutaneous emphysema
POD 5	-	96	Ryle's tube removed
POD 6	-	96	Subcutaneous emphysema resolved

After 15 days, we recalculated the Tanaka Index

Hernial Sac Volume = 655.7cc

Abdominal Cavity Volume (ACV) = 11803cc

Volume ratio= $\frac{HSV\%}{ACV} = 55\%$

3.2 Proposed Plans of Treatment

Before patient is posted for surgery we had 2 plans of surgical interventions:

Plan A -

The original plan was to approach the hernia through inguinoscrotal incision and reduce the contents through inguinal incision and perform Lichtenstein Tension Free Hernioplasty.

Plan B -

If the patient develops abdominal compartment syndrome in the intra operative period, or if the contents cannot be reduced, the plan was to perform omentectomy and right hemicolectomy as well as splenectomy and ileostomy through a midline laparotomy incision.

Procedure

An inguinoscrotal incision is given on the right side. Incision deepened till External Oblique Aponeurosis (EOA) is identified.

An oblique incision is given on EOA approximately 2 cm above the inguinal ligament.

Incision extended laterally and medially up to medial border of the superficial ring.

Sac is identified and opened.

The contents seen were omentum, small bowel, transverse colon, cecum and appendix.

Omentectomy was done and the contents were slowly and gradually reduced for approximately 1 hr.

Right testis adherent to sac was identified and found to be undescended.

The sac is separated from right testis and Right Orchidectomy was done.

Sac is obliterated and transfixed and reduced into the abdomen.

15x15cm prolene mesh is placed over the posterior wall of the inguinal canal.

The mesh is initially fixed to pubic tubercle then medially to laterally to inguinal ligament at different levels.

Later, the mesh is fixed superomedially to conjoint tendon. A suction drain is placed over the mesh.

Another suction drain is placed in the scrotum. EOA approximated using 2-0 Vicryl. Incision was then closed in layers.

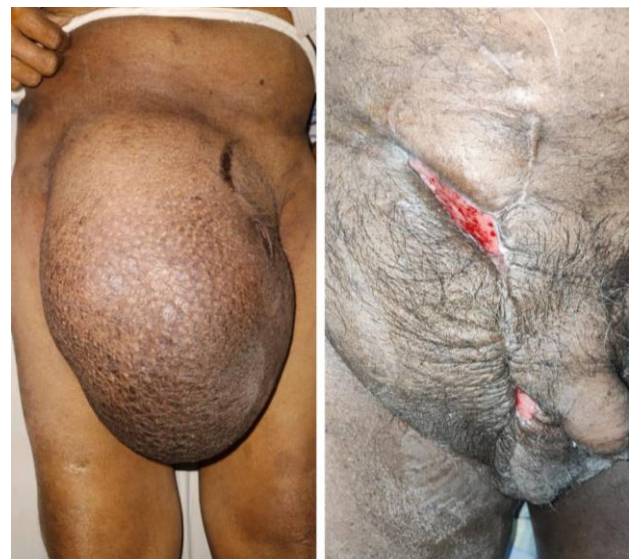
Peri operative events:

- During extubation, patient developed bradycardia and hypotension.
- Inj. Noradrenaline 8mg 4ml/hour was started and titrated according to the blood pressure values.
- Abdominal compartment syndrome was suspected.
- The next step was to go for PLAN B.
- Patient became vitally stable in a few minutes and inotropic support was stopped and extubation was performed without any difficulty.
- As the intra-abdominal pressure couldn't be measured, there was suspicion of Grade 1 IAH which can be managed conservatively.
- PLAN B was abandoned
- Patient was shifted to RICU for O2 support and monitoring.

3.3 Postoperative Complications

Post operatively, the patient had complaints of back pain and epigastric pain till POD 3.

There were no other complaints.



pre-op

post-op

Figure 4: Preoperative and Postoperative surgical site pictures

4. Discussion

In an attempt to reduce the dreadful complications post-operatively, paralysis of lateral abdomen muscles using botulinum toxin and stretching of the said muscles through preoperative progressive pneumoperitoneum was thought to be beneficial for giant inguinal hernias.

Such large hernias have significant increased risk of numerous post-operative complications such as intra-abdominal hypertension, abdominal compartment syndrome, recurrence, back pain and abdominal discomfort.

One of the dreaded complications is intra-abdominal hypertension.

The World Society of Abdominal Compartment Syndrome (WSACS) was created in 2004 as this disease is often underdiagnosed in the medical field.

Intra-abdominal hypertension (IAH) is defined as a sustained intra-abdominal pressure ≥ 12 mmHg.

The WSACS recommended that IAH be divided into four grades as follows:

Grade I: IAP 12-15 mm Hg

Grade II: IAP 16-20 mm Hg

Grade III: IAP 21-25 mm Hg

Grade IV: IAP >25 mm Hg

Abdominal compartment syndrome (ACS) is defined as a sustained intra-abdominal pressure >20 mmHg (with or without APP <60 mmHg) that is associated with new organ dysfunction.

Consequences of this increase in abdominal pressure:

a) Cardiovascular System

IAH functionally obstructs blood flow in the inferior vena cava thereby leading to diminished venous blood flow from the lower extremities. This then increases the risk of Deep Vein Thrombosis.

An increase in Central Venous Pressure (CVP) and Pulmonary Capillary Wedge Pressure (PCWP) also impairs cardiac function by decreasing venous return.

b) Pulmonary System

There is decreasing Tidal Volume (TV) and Functional Residual Capacity.

Hence, elevated intrathoracic and airway pressures lead to barotrauma and lowers pulmonary compliance.

Alveoli exhibit atelectasis, increasing the dead space. Thus, gas exchange is adversely affected leading to hypoxemia and hypercarbia. There is also an increased risk of postoperative pulmonary infections.

c) Renal System:

Renal vein compression increases venous resistance, which impairs venous drainage. Renal artery vasoconstriction is seen due to stimulation of sympathetic nervous system and Renin Angiotensin Aldosterone System, which are stimulated by the fall in cardiac output.

The end result is progressive reduction in both GFR, urine output and urine sodium and chloride concentrations.

d) Gastrointestinal System:

The gut appears to be one of the organs most sensitive to increases in intra-abdominal pressure:

- IAH causes compression of splanchnic blood vessels which impairs venous flow from the intestine and causes intestinal edema. This intestinal edema further increases

intra-abdominal pressure, initiating a vicious cycle. The end result is worsened hypoperfusion, bowel ischemia, decreased intramucosal pH, and lactic acidosis.

- Hypoperfusion of the gut may incite loss of the mucosal barrier, with subsequent bacterial translocation, sepsis, and multiple system organ failure.

e) Hepatic System:

Decreased hepatic flow leads to impaired metabolism and clearance, contributing to metabolic acidosis.

f) Central Nervous System:

- There is an increase in intracranial pressure with a subsequent decrease in the cerebral blood flow.
- Increased PaCO₂ also causes increased arterial blood flow to the brain, further increasing intracranial pressure.
- Impaired Cerebral Perfusion Pressure (CPP) leads to cerebral ischemia.

It is a necessity to reduce such dangerous consequences for a better post-operative outcome in order to reduce the morbidity and mortality of patient.

5. Conclusion

In our case, we adopted a multidisciplinary approach which provided to be helpful towards an optimal outcome. With the support of Radiologist, we could calculate loss of domain which in our case was significant. We adopted the technique of using botulinum toxin to paralyse the lateral abdominal muscles which leads to the increase in abdominal wall compliance and hence abdominal volume. We also used the creation of pneumoperitoneum to further stretch the paralysed abdominal muscles, but this was discontinued due to the development of subcutaneous emphysema. There is no clear protocol made for such giant inguinal hernia which carries significant morbidity, mortality and recurrence. Hence, there is need for proper treatment protocols for such giant hernias.

References

- Cubero, José Ángel Ortiz; Soto-Bigot, Marco; Chaves-Sandí, Marcelo; Méndez-Villalobos, Armando; Martínez-Hoed, Jesús. Surgical treatment for inguinoscrotal hernia with loss of dominion with preoperative progressive pneumoperitoneum and botulinum toxin: Case report and systematic review of the literature. *International Journal of Abdominal Wall and Hernia Surgery* 4(4):p 156-165, Oct-Dec 2021. | DOI: 10.4103/ijawhs.ijawhs_35_21
- Van Rooijen, M. M. J., Yurtkap, Y., Allaey, M., Ibrahim, N., Berrevoet, F., & Lange, J. F. (2021). Fascial closure in giant ventral hernias after preoperative botulinum toxin a and progressive pneumoperitoneum: A systematic review and meta-analysis. *Surgery*, 170(3), 769–776. <https://doi.org/10.1016/j.surg.2021.03.027>
- Subirana, H., Comas, J., Crusellas, O., Robres, J., Barri, J., Domènech, A., Borlado, C., & Castellví, J. (2023). Preoperative progressive pneumoperitoneum in the treatment of hernias with loss of domain. our experience in 50 cases. *Journal of Abdominal Wall Surgery*, 2. <https://doi.org/10.3389/jaws.2023.11230>