

Gracilis Muscle Transposition Should Be Strongly Considered as the Treatment of Choice for Complete Fecal Incontinence

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1. Abstract

1.1. Purpose: The degree of anal incontinence range from simply incontinence to flatus or liquid to solid stool. Surgery may be carried out if conservative measures alone are not sufficient to control incontinence. Isolated sphincter defects (IAS/EAS) may be treated with sphincteroplasty and if this fails, neosphincter with gracilis muscle transposition (graciloplasty) or artificial anal sphincter may be indicated.

1.2. Materials and Methods: This is a retrospective analysis of a single surgeon's experience of seven patients who had surgical treatment of complete anal incontinence with gracilis muscle transposition in a tertiary referring medical center. There were six females and one male. Age ranged from 14 to 34 years old (average of 24.1 years old).

1.3. Result: The cause of incontinence were post surgery for imperforate anus in three patients, post vehicle trauma in two patients, post chemoradiation for rhabdomyosarcoma in one patient and unknown etiology in one patient. A patient had perineal sigmoidectomy for rectal prolapse eight years and 17 years later. The patients in this series showed high rate of satisfaction following surgical treatment for anal incontinence.

1.4. Conclusion: In patients with serious injury to the anal sphincter, gracilis muscle transposition is the treatment of choice for complete anal incontinence.

2. Introduction

Anal incontinence occurs in both men and women. The degree of

incontinence range from simply incontinence to flatus or liquid to solid stool. Surgery may be carried out if conservative measures alone are not sufficient to control incontinence. Isolated sphincter defects (IAS/EAS) may be initially treated with sphincteroplasty. If this fails, operation for supplementing the sphincter mechanism such as neosphincter with gracilis muscle transposition (graciloplasty) or artificial anal sphincter may be indicated[1]. Gracilis muscle was selected on the basis of the gracilis muscle (Latin for "slender") being the most superficial muscle on the medial side of the thigh, is thin and flattened, broad above, narrow and tapering below to a tendon which inserts below the tibial tuberosity. The major blood supply enters proximally so that diversion at the insertion and mobilization of the muscle to the proximal neurovascular bundle do not compromise viability. When gracilis muscle adducts, medially rotates (with hip flexion), laterally rotates, and flexes the hip as above, and also aids in flexion of the knee. As a functioning pedicled flap, the gracilis muscle can be transferred for the treatment of anal incontinence. This technique called graciloplasty was described in the 1950s by Pickrell [2] and was revolutionized in the late 1980s by the introduction of chronic muscle electro-stimulation. Because of limited number of the patients and limited expertise of the surgeons, not many colorectal surgeons have much experience of the procedure which is beneficial for the patients who needed.

3. Materials and Methods

The study was approved by the institutional review board of Mackay Memorial Hospital in Taipei (No.23MMHIS399e) This is a retrospec-

tive analysis of a single surgeon's experience of surgical treatment of complete anal incontinence with gracilis muscle transposition in a tertiary referring medical center. From March 1985 to April 2023, seven patients had surgical treatment of complete incontinence by gracilis muscle transposition for various causes. There were six females and one male. Age ranged from 14 to 34 years old (average of 24.1 years old). According to the previous report of the procedure of gracilis muscle transposition, operative technique were as following: Patients were placed in the perineolithotomy position to expose the thighs and the anus. The three medial incisions required to mobilize the gracilis muscle were in the upper thigh, in the mid-thigh, and across the knee joint. The muscle was identified initially through the proximal incision, and the dissection was carried cephalad to the neuromuscular bundle, which was the upper limit of the dissection. The muscle was mobilized to the tendinous insertion. The tendon was divided. The muscle was delivered through the proximal incision. Curvilinear incisions were made approximately 1.5 cm from the anal verge anteriorly and posteriorly. A raphe was preserved. A tunnel was developed between the proximal thigh incision and the anterior perianal incision, and the muscle was pulled around them as a pulley. A tunnel was developed in the extrasphincteric space on either side of the anal canal. The tendon was passed clockwise. After the tension was passed 360 degree and behind the muscle, an incision was made over the contralateral ischial tuberosity. Monofilament non-absorbable polypropylene sutures were placed in the gluteal fascia and held in place. The tendon was pulled through a tunnel developed between the ischial incision and the anterior perianal incision. The leg from which gracilis muscle was taken was removed from the stirrup and abducted. With maximal adduction the tendon was pulled taut. The sutures were placed to the tendon and secured. All incisions were closed.

4. Result

The cause of fecal incontinence were post surgery for imperforate anus in three patients, post vehicle trauma in two patients, post chemoradiation for rhabdomyosarcoma in one patient, and unknown etiology in one patient. A patient had wound infection of the donor site that cleared after wound care. A patient who was post chemoradiation for rhabdomyosarcoma had perineal sigmoidectomy for rectal prolapse eight years and 17 years later. All patients in this series showed high rate of satisfaction following surgical treatment for anal incontinence.

4.1. Illustration of a Case

A twenty-one year-old female presented with severe pelvic injury following motor vehicle trauma on 1985/3/10. She presented with retraction of the anus upward into the peritoneal cavity (disappearance of anal opening with complete disruption of all anal sphincters) (Figure 1). Reconstruction of the anus with repair of the sphincters, subcutaneous tissue and skin with creation of a colostomy on 1985/3/10. She was found to have complete anal incontinence without any sphincter function. Gracilis muscle transposition

was performed on 1986/10/13. She had a closure of colostomy on 1987/3/23. She was satisfied with result that she was able to control stool passage when last seen on 2019/02/02.



Figure 1: Retraction of the anus upward into the peritoneal cavity (disappearance of anal opening with complete disruption of all anal sphincters)

5. Discussion

Anal incontinence occurs in both men and women. The degree of incontinence range from simply incontinence to flatus or liquid to solid stool. Etiology of fecal incontinence include (1) previous operative procedures such as previous anal operations; internal sphincterotomy; fistula surgery; hemorrhoidectomy; manual dilation of anus; sphincter-saving procedures; (2) childbirth; (3) previous hysterectomy; (4) aging; (5) procidentia; (6) trauma; (6) primary disease; (7) irradiation; (8) neurogenic causes; (9) idiopathic incontinence; (10) congenital abnormalities; and (11) miscellaneous. The exact percentage of incontinence attributable to each of the various causes is unknown. In one series, the most common causes of fecal incontinence were injury sustained to muscles and nerves during operation and peripheral nerve injuries associated with systemic disease such as diabetes. Spinal cord injuries or defects involving spinal cord injuries accounted for most of cases [3]. In most series, obstetric and operative injuries account for most cases of incontinence. The variation often depends on the type of referral practice and the special interests of the authors. Diagnosis of anal incontinence depended on history taking, physical examination, anorectal endosonography, the "Enema Challenge", BE, magnetic resonance, imaging, anal manometry, defecography, electromyography, pudendal nerve terminal motor latency, rectal compliance etc [4]. Treatment of anal incontinence include non-operative procedures or operative procedures. Non-operative procedures include medical treatment, continence plugs, bio-feedback training, secca procedure, and hyperbaric oxygen. Surgery may be carried out if conservative measures alone are not sufficient to control incontinence. Operative procedures include anterior anal sphincter repair, postanal repair, repair of rectovaginal fistula, gracilis muscle transposition, gluteal muscle transposition, artificial sphincter implantation, implantation of silicone biomaterial, sacral neuromodulation (SNM), or colostomy. Isolated sphincter defects (IAS/EAS) may be initially treated with sphincteroplasty and if this fails. Neosphincter with gracilis muscle transposition (graciloplasty) or artificial anal sphincter may be indicated for severe incontinence. Mongardini

FM et al [5] reported short- and long-term outcomes of sphincteroplasty for anal incontinence related to obstetric injury: a systematic review. Overall 355 patients with obstetric sphincter damage underwent sphincteroplasty with an anterior external sphincter overlapping procedure. A consistent improvement in fecal incontinence at short-term follow-up with relative improvement in QoL was reported. In 7 of 8 studies, the authors found a progressive worsening of the incontinence symptoms on the long-term follow-up. A properly performed sphincteroplasty can guarantee a consistent improvement of the continence in short-term with encouraging outcomes, especially for solid stool continence, in long-term. They believe that anterior sphincteroplasty, as a low cost, feasible, and safe procedure, still has a role in the treatment of fecal incontinence for obstetric injury. Fang DT et al reported [6] overlapping sphincteroplasty for acquired anal incontinence stated that when defects of the anal sphincter are caused by trauma, surgical correction can be successful even in long-standing cases. At the University of Minnesota, they used overlapping sphincteroplasty in 79 patients with fecal incontinence from 1952 to 1982. There were 62 women and 17 men. Ages ranged from 17 to 68 years. Incontinence had been present from three weeks to 40 years and had been caused by childbirth, previous anorectal surgery, trauma, or rectal prolapse. Following overlapping sphincteroplasty, there was one postoperative death and 13 complications. Complications included temporary difficulty in voiding, excessive bleeding, abscess formation, fecal impaction, and hematoma. Seventy-six of the 78 surviving patients were followed for an average of 35 months. Results ranged from excellent to poor with only one failure. From our experience it was concluded that several factors were important for good surgical results: 1) The patient must have intact neuromuscular bundle with detectable voluntary sphincter contraction. 2) If a primary repair has failed, a minimum duration of three months should elapse before overlapping sphincteroplasty is attempted. 3) Scar tissue from the severed muscles should not be excised. 4) The internal and external sphincter muscles should not be separated. 5) A temporary concomitant colostomy is not necessary. Pickrell KL et al [2] reported their experience of four cases in children about construction of a rectal sphincter and restoration of anal continence by transplanting the gracilis muscle. Christiansen J et al [7] reported experiences of gracilis muscle transposition for fecal incontinence. They stated that all patients who benefited from the operation had an increase in maximum squeeze pressure. The ability to retain a viscous fluid in the rectum was measured in seven patients, four of whom had gained satisfactory continence and three of whom had improved continence. They were able to retain a median volume of 200 ml (range 50-225 ml) without leakage compared with 325 ml (range 250-400 ml) in the control group. These patients could retain

the maximum amount of viscous fluid for 5-8 min, whereas all control subjects could do so for more than 15 min. It is concluded that, although gracilis transposition never results in normal continence, acceptable continence may be achieved in selected patients provided careful attention is paid to the technical details of the procedure and provided that systematic postoperative exercises are performed. Cear SM and Wexner SD [8] in 2005 reported in an article "Muscle Transposition: Does It Still Have a Role?" that since the early 1900s, skeletal muscle transpositions have been employed for complicated cases of fecal incontinence to augment or replace the anal sphincter, multiple techniques have evolved that vary with the type and configuration of muscle used in the reconstruction, transposition of the gluteus maximus muscle was popular in the early stages of development but was replaced by techniques involving transposition of the gracilis muscle. Within the past 16 years, electrical stimulators have been applied to the transposed muscle flaps to create a dynamic reconstruction improving the efficacy of these neosphincters over their static counterparts. However, the stimulated versions are technically demanding with a high rate of morbidity secondary to complications of the multiple components and variations in technique. The stimulator used in this procedure has been removed from the US market, although it is still available in other countries. Currently in the United States, gracilis transposition is still employed in the absence of an electrical stimulator as an adjunct to the artificial bowel sphincter (Acticon Neosphincter™, American Medical Systems, Minnetonka, MN), such as in cases of severe muscle loss and congenital atresia. In European countries, the stimulated graciloplasty continues to evolve, leading to expansion of its use in total anorectal reconstruction for anal atresia and after abdominoperineal resection

6. Conclusion

Reconstruction of perineal body and direct repair of sphincter usually had overall good result for mild to moderate fecal incontinence. However, in patients with serious injury to the anal sphincter, gracilis muscle transposition is the treatment of choice for complete anal incontinence. My criteria for improving outcome of gracilis muscle transposition include following: selection of patient who is young, selection of a good donor site, preservation of good vascular and neural supply, tendon has to encircle the anal opening, sutures are placed in the gluteal fascia through the ischial tuberosity incision, and adduction of the thigh before the tendon is secured.

7. Conflict of Interest statement

None declared.

8. Declaration of Funding

There was no funding of the entire study.

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