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## Total knee replacement in a patient with myasthenia Gravis: A challenge that demands comprehensive perioperative care

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### Abstract

Myasthenia Gravis leads to painless fatigable weakness of specific muscles in the body. It is often associated with comorbidities. A major surgery like total knee replacement in such a patient can lead to myasthenic crisis and many other complications. The success of this surgery depends upon the strength of various groups of muscles. A 66 years old, short, obese, female, with Myasthenia Gravis, Rheumatoid Arthritis and Hypothyroidism was operated for bilateral total knee replacement in single stage. A good preoperative evaluation of the case, anaesthesia and surgical procedure related intraoperative care and a careful postoperative pharmacological and physiotherapy protocol led to a satisfactory recovery during the hospital stay. A comprehensive perioperative care with a team-based approach can lead to a successful outcome after a total knee replacement surgery in a patient with Myasthenia Gravis and other comorbidities.

**Keywords:** Total knee replacement, TKA, myasthenia gravis, neuromuscular disorders, Joint replacement

### 1. Introduction

Total knee replacement (TKR) is a major surgery the success of which depends upon the coordinated functioning of various groups of muscles. Performing such a surgery in a neuromuscular disorder like Myasthenia Gravis (MG) is a big challenge for the surgeon as well as the patient. Myasthenia Gravis is a disorder characterised by weakness of specific muscles in the body<sup>[1]</sup>. It is generally associated with other comorbidities and increases the risk of postoperative complications and exacerbation of MG post-surgery<sup>[2-11]</sup>. Many drugs are contraindicated to be used in the patients with MG<sup>[12]</sup>. Not much previous literature is available in relation to TKR and MG except few<sup>[11, 13, 14]</sup>. Our case was a 66y old female, short, obese and a known case of Myasthenia Gravis with hypothyroidism and rheumatoid arthritis, who presented with bilateral knee severe osteoarthritis. We planned for a bilateral total knee replacement surgery in a single sitting. The patient did well and got discharged happily. TKR can be successfully done in MG provided a comprehensive perioperative evaluation is done and the desired medical and surgical care is taken.

### 2. Case presentation

#### 2.1 Clinical history

A 66 years old, short, obese (BMI 37.99 kg/m<sup>2</sup>), female patient presented with severe pain and deformity in both the knee joints, for 10 years, that had increased for the past 2 years. Initially, she was able to walk with bearable pain without support but for the past 2 years, she had started using stick as a support. She had swelling, on and off, on both the knees with crepitus, difficulty in getting up from the chair and was unable to use the staircase. The patient was a known case of Myasthenia Gravis, Rheumatoid Arthritis and Hypothyroidism. Anti-rheumatoid treatment was stopped 5 years back. She had an episode of severe breathlessness 4 years back associated with weakness in proximal muscles of her upper and lower limb but was failed to be diagnosed with MG. She was diagnosed with MG 2 years back when she started experiencing ptosis and diplopia. Since then, she was started on Tab.

Pyridostigmine 60mg TDS till date. She was taking Tab L-Thyroxin 50mcg; Pyridostigmine 60mg TDS; Tab Prednisolone for the past 10 years, stopped 2 years back.

**2.2 Physical examination**

The patient was walking with walker with a waddling gait. There was a medial and lateral joint line tenderness. Patellofemoral tenderness was present with a negative patellar tap. Range of movement on both the sides was from 0-120 degrees with a positive crepitus and no patellar instability. Varus deformity was moderate on right side and severe on left side. Patient had a mediolaterally lax joint (i.e. Type 1 laxity)<sup>15</sup> with more laxity on lateral side than the medial side. The power of quadriceps muscle was 4/5 for both the knees.



**Fig 1:** Scannogram showing significant preoperative varus deformity.



**Fig 2:** Preoperative X-rays: A. standing AP view B. Lateral view and C. Skyline view.

**2.3 Imaging**

Anteroposterior plain standing X-rays of both the knee joints revealed severe degenerative joint disease with bony deformity and multiple osteophytes. Varus and valgus stress views showed a wide opening of the lateral joint space than the medial joint space. Lateral and skyline images showed the small defect in the tibial plateau as well as patellofemoral arthritic changes. On the scannogram, the varus on the right side was 18 degrees and that on the left side was 22 degrees. As the findings on the x-ray and scannogram were sufficient enough to confirm the diagnosis, no MRI or CT scan was done further.

**2.4 Management**

The patient was planned for bilateral total knee replacement surgery in a single sitting. The doses of Tab. Pyridostigmine 60mg TDS were continued even on the day of surgery. We avoided the use of Inj. Amikacin during urinary catheterisation and did it under the cover of cefuroxime 1.5g given half hour before the incision. Regional anaesthesia (epidural anaesthesia) using the drugs (lignocaine with adrenaline and anawin) was given. Anaesthetist had difficulty with the spinal anaesthesia. The anaesthesia was given in a guarded manner to avoid hypotension. No sedation was given during the surgery. The surgery was done under the tourniquet pressure of 310mmHg. As the anaesthetist confirmed stable patient conditions after finishing one side, we decided to go ahead with the other side. We operated right side first, released the tourniquet, achieved haemostasis and then started with the surgery of the left side. We used midline skin incision with a medial parapatellar arthrotomy. For balancing the knee, we preferred using the measured resection technique with minimal soft tissue release, owing to the laxity of the joint. The implant we used was a fixed bearing posterior stabilised type of total knee prosthesis. The total tourniquet time on the right side was 18 mins and on the left side was 22 mins, before deflation. Deflation of the tourniquet was done in a gradual controlled manner.

Post operatively, patient was shifted to the ICU setup where ventilator facilities and all other emergency equipments were readily available. As the effect of anaesthesia started weaning off, we started the ropivacaine infusion immediately, to avoid severe pain. Pyridostigmine 60mg was given even during the postop NBM period. Patient had one episode of difficulty in breathing on the 3<sup>rd</sup> post-operative day, managed with Budesonide nebulisation.

For pain management, we used epidural ropivacaine infusion, NSAIDs (oral/intravenous/local patch/suppository) as and when required and avoided the use of usual skeletal muscle relaxants. We avoided buprenorphine patch, other opioids, gabapentin, pregabalin and sedatives.

Chest physiotherapy, incentive spirometry and O2 mask inhalational support at 2 litres was given prophylactically postop. Icing was used for both the knees. 3 doses of i.v. 500mg Tranexamic acid were given, first dose being intra-op and subsequent doses at 12hrly intervals.

**Table 1:** Post-op physiotherapy protocol during hospital stay

| POD-0                    | In Bed Static  |
|--------------------------|--|
| POD -1                   | <ul style="list-style-type: none"> <li>▪ Static and dynamic quadriceps, hamstrings and VMO exercises</li> <li>▪ Bedside sitting</li> <li>▪ Walking few steps with walker</li> </ul>  |
| POD-2                    | <ul style="list-style-type: none"> <li>▪ 20 steps</li> <li>▪ Bedside toilet training</li> </ul>  |
| POD-3                    | <ul style="list-style-type: none"> <li>▪ 30 steps</li> <li>▪ Toilet training in washroom</li> </ul>  |
| POD-5 (Day of discharge) | <ul style="list-style-type: none"> <li>▪ Sitting bedside on her own</li> <li>▪ Active SLR 30-40 degrees</li> <li>▪ Active leg extension 40-50 degrees</li> <li>▪ Active flexion 70-80 degrees (in bed), 90 degrees (bedside)</li> <li>▪ 50-60 steps with walker</li> <li>▪ 5 steps of staircase up and down</li> </ul> |



**Fig 3:** Postoperative clinical photographs of A. Corrected varus deformity B. Left Knee ROM on POD-5 and C. Right knee ROM on POD-5



**Fig 4:** Postoperative clinical photographs of A. Corrected varus deformity B. Left Knee ROM on POD-5 and C. Right knee ROM on POD-5

### 3. Discussion

Myasthenia Gravis is an autoimmune disease which involves peripheral cholinergic receptors of neuromuscular junctions [16]. Dhallu MS, Baiomi A, Biyyam M and Chilimuri S found that younger women are more commonly affected than the middle-aged adults [17]. However, as per the study of Pakzad Z, Aziz T and Oger J, the incidence of myasthenia gravis is increasing in elderly population [7]. Carr AS, Cardwell CR, McCarron PO and McConville J. in their study found that between 1950-2017, the incidence rate of MG was 5.3 and the prevalence rate was 77.7 per 100,000 population while the mortality rate was 0.1-0.9 per 100,000 population [18].

The patient in our study had a history of ocular myasthenia. [19] MG generally manifests as a painless fatigable weakness of specific muscles in the body [1, 20]. Usually starting with the ocular weakness, it may progress to a more severe generalised form involving muscles of the extremities or of the basic life functions [1, 21].

Our patient had associated RA and hypothyroidism. MG often presents in association with other autoimmune diseases such as rheumatoid arthritis, thyroid disease, systemic lupus erythematosus, cardiomyositis, polymyositis/ dermatomyositis, subclinical heart dysfunction and cancer, proven by the studies done by J. B. Andersen *et al.*, N.E. Gilhus *et al.* and Fang *et al.* [22, 23, 24]. This makes the medical treatment of MG complex. However, J. B. Andersen *et al.* and Alshekhlee *et al.* found that the mortality from myasthenia gravis has been reduced to a great extent due to the recent advances in the medical science [22, 25].

Regional anaesthesia being safe in MG, we preferred epidural [26, 27, 28]. As stated by Puneeth *et al.*, [29] the patients with MG are more prone to heart rate and blood pressure variabilities,

hence, we tried to avoid the hypotension by giving the anaesthesia in a guarded manner. The use of sedatives precipitates respiratory distress as the respiratory muscles are already weak in MG, stated by Dillon FX, in 2004. [28] Hence, sedatives were not used [28, 30].

It was found by Chang *et al.* that the patients with MG have increased bleeding tendencies and risk of subsequent complications post-surgery [13]. The patient, in our case, was not on any immunosuppressive medication. Also, the preop INR was 1.01. Hence, the chances of having increased bleeding tendency were less. However, we still tried to control the blood loss by faster surgery, use of the tourniquet, achieving haemostasis after tourniquet release and using intra-op and post-op tranexamic acid. Less tourniquet time along with inflating of the tourniquets one after the other and deflating them in a gradual controlled manner helped us reduce the subsequent risk of myasthenic crisis [11, 31]. Previous work by Brodsky MA and Smith MA found that the use of prolonged bilateral tourniquets is associated with increased risk of myasthenic crisis in patients with regional anaesthesia and lower limb surgery. It was also stated that supplemental measures like anticholinergic and ventilatory support must be available at hand if such a procedure is being undertaken. All such precautions were taken in our case [11].

Drugs in MG have to be used with caution. Wittbrodt ET in 1997 described several drugs known to exacerbate MG which include antibiotics (like aminoglycoside, fluoroquinolones, macrolides, clindamycin); Non-depolarising neuromuscular blocking agents (like pancuronium, atracurium); cardiovascular drugs (like beta-blockers, calcium channel blockers); anaesthetic drugs (like procaine, lidocaine, sevoflurane, neuromuscular blocking agents); anticonvulsant



and other drugs [12]. Pyridostigmine 60mg was not stopped even during the NBM period (preop and postop) to avert the risk of respiratory complications [28, 32]. Dillon FX, in his study, has mentioned that oral dose of pyridostigmine is, in fact, recommended prior to the induction of anaesthesia.<sup>28</sup> We avoided the use of buprenorphine patch due to its potential for respiratory depression, which MG patient is already at risk of [2-8, 11, 27, 30, 32]. We avoided the use of gabapentin and pregabalin due to the muscle weakness that may be aggravated by them [30].

The stressed caused by the pain can itself precipitate myasthenic crisis [32]. Hence, we tried to control the pain by using epidural infusion, [32] NSAIDs that are safe, [30] ice packs [33] and going slow with the mobilisation protocol.

Some of the previous studies found that the myasthenic patients are predisposed to exacerbated muscle weakness, cholinergic and myasthenic crisis and residual muscle paralysis perioperatively [2-8, 11] Chang *et al.* found in his study that patients with MG are at higher risk of postoperative pneumonia, septicemia, postoperative bleeding and other complications [13]. The risk of postoperative complications is more in females and in patients having prior history of hospitalisation, thymectomy, emergency visit, low income and high medical expenditure [13]. We tried to prevent the potential respiratory complications by starting chest physiotherapy, incentive spirometry and O<sub>2</sub> inhalational support immediately postoperatively [2-8, 11, 27] but still experienced one episode of breathing difficulty on POD-3.

We found that the patient had a relatively greater duration (5 days) of the hospital stay. The reasons we noticed were limited options for the pain control, the slow mobilisation protocol that we had to follow and the episode of breathlessness on POD-3. However, the patient went home walking happily.

Thus, a coordinated and planned execution of the management protocols after a detailed evaluation of the case led to the successful outcome for the patient and the surgeon both.

#### 4. Conclusion

A thorough preoperative evaluation of the case, judicious use of selected drugs, good surgical planning and execution and a careful postoperative protocol for pain management and physiotherapy can lead to a successful outcome after total knee replacement surgery in a patient with MG and associated co-morbidities.

**5. Abbreviations** MG: Myasthenia Gravis; POD: Postoperative Day; TKR: Total Knee Replacement.

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