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1. What are the pearls for successful orbital decompression in TED?

JY: (a) Use CT imaging and volume analysis software for preop planning if available.
(b) Achieve max volume expansion by going with 2 walls or 3 walls balanced decompression.

DK: Desired proptosis reduction is the key driver of how much decompression to perform. If minimal proptosis reduction is desired (<2mm), then fat decompression may be all that is necessary. Conversely if 10 mm reduction is desired, a maximal three wall decompression with lateral rim removal combined with fat decompression is likely needed. Planning should also include axial and coronal CT imaging with analysis of bony volume as well as type of soft tissue involvement (ie. muscle or fat predominance). Finally in bony decompression, fenestrating the periorbita to allow soft tissues to enter the newly created space is also key.

2. What are the Surgical pearls please for successful strabismus surgery in TED?

SMA: Small recess, not-absorbable sutures, always in phase of immunological stability.

AV: Review the webinar from the beginning. Methods and tips for successful surgery are covered in the webinar.

- (a) Measure carefully
- (b) Look at scans, especially sagittal scans to look at vertical recti
- (c) Perform Force Duction tests pre-operatively to determine which muscles are tight (including obliques)
- (d) In general, recessions are the operations of choice
- (e) Consider semi-adjustable sutures for inferior rectus recession
- (f) Remove the lower lid retractors during inferior rectus recession in order to limit lower lid recession post-op

MY: (a) Aim for stability of disease and stability of deviation
(b) Avoid surgery except for disabled patient
(c) FDT should be done to choose the right muscle to operate one
(d) Use of semi adjustable technique for IR recession

SWL: You can't fix them all.

- (a) Surgical tables are not as reliable as other forms of strabismus
- (b) Smaller than normal recessions sufficient for larger deviations
- (c) Use adjustable sutures to fine-tune intra-op matching of restrictions as well as postop alignment and preferred head posture
- (d) Anticipate and reduce the risk of late overcorrection associated with IR recession

3. What dose of BOTOX would you recommend to start with?

SMA: Higher doses than in other strabismus, depends on deviation, chronicity, history, for example start with 10 IU, reinforce toxin by 3 months of first injection.

MY: I use 7.5 to 10 U

4. Why do you aim for under correction in strabismus surgery?

SMA: You can add botulinum

AV: This is true for inferior rectus recession but not for horizontal surgery. The effect of the recession tends to progress over the first few weeks post-op. By leaving the vertical deviation slightly undercorrected, the risk of hypertropia reversal is less.

MY: aim for under correction for IR recession because of slippage

MT: late overcorrections can occur especially after vertical muscle surgery

SWL: for the inferior rectus recession, there is a tendency towards overcorrection due to many possible factors including basic change in muscle contractility or restriction, associated inflammation, anomalous adhesions around Lockwood's ligament. Hence the need for undercorrection to compensate .

For medial rectus recession, there is not much overcorrection and hence undercorrection is not required unless the MR is extremely tight.

5. So, with absorbable sutures: could they be the cause for this: we see patients after Recession of Inferior Rectus, who are fine the first weeks after surgery, but some weeks later get a deficit of downgaze and hypertropia. should we use non-absorbable sutures to prevent this?

SMA: Yes, that's a good reason

AV: This is rarely because the muscle has slipped, especially if hang-back sutures have not been used. By fixing the inferior rectus to the globe (and using semi-adjustable sutures), this risk is minimised. Reversal of hypertropia can still be a problem with non-absorbable sutures because the cause is often because other muscles have been affected by the disease.

MY: use semi adjustable technique as by B Kushner

MT: Yes, non-absorbable sutures can prevent, but they can have other problems such as recurrent inflammation, suture granulomas, etc.

SWL: That is an option too but disadvantages include inflammation , granulomas etc

6. If you use BTXA before the patient stabilises, is it possible that you may miss out on the progression of the disease, or if Myasthenia coexists?

SMA: Since strabismus has been identified and the indicated toxin is applied, the changes correspond to what was injected (even less response); they do not generate confusion. In the presence of myastheniform disease there is no worsening on the weakened plaques since the toxin is injected into the opposite.

7. When you talk about high doses, is it around 20 u or more? What is your criteria?

SMA: Yes. Generally, it can be started as a minimum dose of 10 to 15 IU and go up to 20, but the most important thing and depending on the evolution is to add toxin at half time

8. I am interested in serum antibody levels and correlation with disease activity. Does anyone do Calsequestrin (CALQ1) and Collagen XIII antibodies in patients to diagnose euthyroid Graves' disease?

SMA: I have studied the relation with Natural Killer cells

MT: generally these antibody levels do not accurately predict disease activity and they can remain high despite the disease being inactive. Clinically following the patient is the best way

JY: I have not specifically used the serum antibody level in question. I have used Thyroid stimulating Immunoglobulins (TSI) to help with diagnoses at times, though I mostly rely on clinical signs.

9. Also, I have patients with consistently elevated TRAB antibody levels... when is it appropriate to operate on their strabismus?

SMA: always in phase of immunological stability, while stability occurs toxin can be used.

MT: antibody levels are not an accurate marker of disease activity and can remain elevated for decades, Go with stability of the strabismus and clinical activity score

SWL: I would wait till the disease is more stable medically

10. How acceptable is the Luedde instrument for measuring / monitoring mild proptosis (without diplopia)?

SMA: I use the Keeler instrument

JY: it is acceptable as well as a Hertel exophthalmometer.

DK: There are many types of exophthalmometers that accurately measure proptosis. Using the same parameters and reproducibility of measurements are key in following patients over time.

11. What is the effect on lower lid when you inject huge amount of Botulinum toxin?

SMA: I have not had any side effects on the lower eyelid

MY: it is a reversible issue

12. Does injecting BOTOX help in the active stage or when the muscle is fibrotic? Or both?

SMA: In both. Since it is not possible to know how much elasticity persists even in fibrotic cases, I always give the toxin a chance

13. Do you use steroids systemically during strabismus surgery in TED?

SMA: If you mean systemic steroids, no. It is preferable to have used them and stabilized the immunological changes prior to any strabismus surgery; If during the surgery I see a great inflammatory process, I ask the anaesthesiologist to pass a dose of intravenous steroid at the end.

MY: No

MT: I do not

SWL: No, not during

14. Do you use vessel sparing surgery for inferior rectus in case both medial rectus and superior rectus involvement?

SMA: Usually not

AV: No, I don't use vessel sparing surgery. I am usually happy to operate on three muscles in each eye. Anterior segment ischaemia is very uncommon with three muscle surgery especially if the muscles are operated at different times and bearing in mind that patients are often not elderly (with compromised circulation).

SWL: I have not done that.

15. For optic neuropathy, do you use change in IOP from primary to upgaze as a monitoring mode?

SMA: I always use the intraocular pressure comparison, not only in up gaze but also towards any other restrictive muscle, for example in abduction when esotropia

MT: No. Please go with visual acuity, color vision, APD and most importantly visual fields

JY: Change in IOP and apd in different gazes, in particular upgaze.

16. Does anyone use VEP for optic neuropathy?

MT: If you can do a good exam, a VEP is not necessary

RG: No

JY: No, as red desat and other color testing is fairly sensitive. But I can see the utility of VEP in non-verbal or un-cooperative patients.

17. A TED case had been wrestled from plastics & medicine for 3 years before seeing a strab. surgeon; iv methylpred, etc. given, but no fat decompression / floor decompression done. There was a Large ET > 70. It was Operated on - BE MR recess (muscle relaxed to max. loose position to free restriction approx. -9, with 8 units Botox to each muscle). One month post op still ET > 50, but in the OT, it was noted that the SR & IR were bulky / tight but no sig. vertical, so therefore not addressed. What would you do next? Ask for fat decompression? Recess again (but already very far back, right?)? LR resect?

AV: I don't think fat decompression will make a significant difference to a 50PD ET (although it may make a bit of a difference, so if there is an issue with proptosis and it is necessary anyway, it is worth considering.)

Recess again (but already very far back)?

I would look at scans and assess what the muscles look like, particularly LR. Is the LR relatively spared? because, if it is, resection is an option.

I would also do FDTs looking particularly at how tight the MR and LR are. If the MR are still significantly restricted, further recession will be a necessary part of the next surgery. If the LR is not restricted on FDT, then further MR recession can be accompanied by a conservative LR resection (on adjustable). If the MR FDT shows minimal restriction, then LR resection alone may be the best option. If the MR is recessed further, there is a risk of adduction limitation, but the objective of surgery is to provide the patient with an area of central BSV, with or without prisms so this may be a price worth paying.

SWL: LR resect is a viable option