Capsulo-Cortical Adhesions (CCA) and Phacoemulsification (PE)

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One of the basic requirements of modern techniques of phacoemulsification is free rotation of the nucleus. A freely mobile nucleus is a sign that it is totally separated from the capsular bag and subsequent maneuvers of the nucleus are likely to place minimal stress on the zonules. Rotation is achieved by cortical cleaving hydrodissection which separates the nucleus from the capsular bag.

Sometimes it may be difficult or impossible to rotate the nucleus despite meticulous cortical cleaving hydrodissection. If faulty technique of cortical cleaving hydrodissection has been ruled out, it is usually the presence of capsulo-cortical adhesions that makes nucleus rotation difficult.

Capsulo-cortical adhesions are characterized by adhesions between the capsule and cortex (Figures 1a and 1b). These adhesions may be anterior, posterior, equatorial or any combinations of the above. Unlike in a cortical cataract, there is no definite area of translucence visible between the capsule and the underlying opaque cortical layers in capsulo-cortical adhesions. Opacity exists in the outermost layers of the cortex that is adherent to the lens capsule. These adhesions can be assessed at the slitlamp as well as the operating microscope, to a certain extent.

This prospective study was conducted to look into the peculiarities and difficulties faced by the surgeon while operating on cataracts with capsulo-cortical adhesions. The goal was to prepare a guideline for safe management of these cases.

Patients and Methods

86 consecutive patients with capsulo-cortical adhesions scheduled for phacoemulsification (Group A) were included in this prospective study. The diagnosis of capsulo-cortical adhesion was made intraoperatively just before starting the surgery with the patient under the operating microscope after prepping and draping of the patient. The intraoperative findings were matched with the slitlamp examination findings documented in the casesheet during preoperative evaluation. All these patients had been preoperatively assessed at the slitlamp with a fully dilated pupil. Exclusion criteria included patients with prior ocular surgery, ocular disease, complicated cataract and nondilating pupils. 20 consecutive patients with routine uncomplicated cataract, scheduled for phacoemulsification were also included in the study as controls (Group B). The exclusion criteria,
surgical technique and protocols were the same in each group.

Phacoemulsification was performed by a single surgeon (AC). All surgeries were performed under topical anesthesia with 2 % xylocaine jelly through the temporal clear corneal approach. The anterior capsule was stained with trypan blue dye (0.06 %) under an air bubble. Continuous curvilinear capsulorhexis was performed under 2 % hydroxypropyl methyl cellulose using a 26 gauge bent needle. A three-site cortical cleaving hydrodissection (3,9 and 6 o’clock) was performed by injecting BSS through a 26-gauge cannula attached to a 2 ml syringe. The cannula tip was advanced under the anterior capsule approximately till the capsular fornix, the anterior capsule tented and BSS was gently injected until a complete fluid wave was observed between the lens and the posterior capsule. The shallowing of the anterior chamber was also considered as one of the endpoints of cortical cleaving hydrodissection. The capsular bag was decompressed by gently tapping on the anterior lens capsule with the hydrodissection cannula itself. The anterior chamber was refilled with viscoelastic and nucleus rotation was attempted with a Sinskey hook through the side port. If the nucleus did not rotate freely, no effort was made to attempt a forcible rotation. Additional multiquadrant hydrodissection was performed in two more sites that also included the area of capsulo-cortical adhesion. The cannula was also passed subcapsularly in an attempt to lyse the anterior capsulo-cortical adhesions by employing the concept of hydrofree dissection. Nucleus rotation was attempted again and the surgeon noted down the subjective difficulty encountered during nucleus rotation. If the nucleus did not rotate, another round of cortical cleaving hydrodissection was repeated once again at two different points. Subsequently, phacoemulsification was performed. A phacochop or stop and chop phacotechnique was employed using the Bausch and Lomb Millennium phaco unit. The surgeon looked out for any peculiarity or uniqueness in these cases. All cases were recorded in a DVD. Subsequently each of the recorded cases was analysed for a) the total duration of the actual surgical procedure, b) the total time required to perform rhexis and c) the total time required for cortical cleaving hydrodissection.

Results

86 patients were noted to have capsulo-cortical adhesions at the start of the surgery. The average age

<table>
<thead>
<tr>
<th>Group A (N = 86)</th>
<th>Group B (N = 20)</th>
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<tbody>
<tr>
<td>Age (Years)</td>
<td></td>
</tr>
<tr>
<td>Upper limit</td>
<td>87</td>
</tr>
<tr>
<td>Lower limit</td>
<td>46</td>
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<tr>
<td>Mean</td>
<td>67</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>43</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
</tr>
<tr>
<td>Associated systemic disease</td>
<td>19 (22.09 %)</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>5 (25 %)</td>
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</table>
of the patients was 67.1 years (range 46 years to 87 years). The sex distribution was even with 43 patients in each category (Table 1).

19 patients had no systemic illnesses with diabetes mellitus being the commonest systemic association. Nucleus rotation could be performed after the first sequence of cortical cleaving hydrodissection in 83 cases. However in 5 of these cases (5.81 %) the rotation was difficult and stressful though no untoward damage like zonular dialysis was noted. It could be completed only after the second sequence of cortical cleaving hydrodissection. In 3 cases (3.49 %) the nucleus could not be rotated. Milky turbid fluid (Figure 2) was noticed to originate from the area of the capsulo-cortical adhesions in 10 patients (11.63 %) at the stage of nucleus decompression during cortical cleaving hydrodissection. There were no significant intraoperative complications like posterior capsular rent or zonular dialysis in any of these patients. Visual recovery of 6/9 or better on the 5th postoperative day was seen in 76 patients (88.37 %).

### Discussion

Free and easy nucleus rotation is an important prerequisite in all the modern techniques of phacoemulsification. It considerably reduces the stress placed on the zonules and capsular bag during removal of the nucleus or nuclear fragments. Cortical cleaving hydrodissection is a step, which is aimed to completely separate the nucleus from its adhesions rendering it freely mobile within the capsular bag. This separation may be difficult or stressful and is at times impossible in the presence of capsulo-cortical adhesions (CCA).

It is therefore important to be able to detect the presence of capsulo-cortical adhesions before the cortical cleaving hydrodissection step. A meticulous dilated slitlamp evaluation preoperatively helps to a great extent in diagnosing the presence of this condition. One should also look for this condition with the patient in extreme gaze. However one may miss the diagnosis of capsulo-cortical adhesion in the presence of a nondilating pupil or a dense cataract. Even if the condition is missed during the preoperative evaluation (for cataract surgery) a surgeon aware of this entity should be in a positon to make a diagnosis of capsulo-cortical adhesion intraoperatively. There were 13 cases (15.12 %) of capsulo-cortical adhesions which were undetected preoperatively and detected intraoperatively in the current study.
Cortical cleaving hydrodissection should be performed meticulously. The cannula tip should tent the anterior capsule and the fluid injection should be performed close to the capsular fornix. Mechanical lysis of the adhesion with the same cannula or a cyclodialysis spatula may be attempted. Signs of successful hydrodissection include a fluid wave across the posterior capsule, shallowing of the anterior chamber due to forward bulging of the nucleus, a prominent capsulorhexis edge and release of trapped fluid from the rhexis margin when the nucleus is tapped back.

We routinely perform 3-quadrant cortical cleaving hydrodissection even in our standard cases before attempting nucleus rotation. The same strategy was adopted in the study too, and this is more likely to lyse the adhesions than a one-point hydrodissection. This explains the high success rate of nucleus rotation in our study after the first sequence of cortical cleaving hydrodissection. No additional force is to be used to rotate the nucleus in the event of any difficulty and a repeat 3-quadrant cortical cleaving hydrodissection is called for.

Sometimes, in spite of a good cortical cleaving hydrodissection, where the posterior fluid wave has been visualized and focal lysis of the capsulo-cortical adhesions has been performed, it may be difficult to rotate the nucleus. It could be due to the presence of equatorial adhesions and further multiquadrant hydrodissection should be done before attempting to rotate the nucleus.

The milky fluid (Figure 2) seen to emanate from the area of capsulo-cortical adhesions (in 10 patients, 11.63%) while decompressing the capsular bag at that area seem interesting. The furry epinuclear surface (Figure 3) present focally at the area of the adhesions were noted in many cases and could be a result of lysis of the fibrous adhesions between the anterior capsule and underlying cortex.

Time required to perform rhexis as well as cortical cleaving hydrodissection was more in the patients with capsulo-cortical adhesions when compared to the control group.

In conclusion, a thorough preoperative dilated slitlamp evaluation should be performed to detect capsulo-cortical adhesions. Intraoperative evaluation also helps to detect some cases of capsulo-cortical adhesions not detected by prior slitlamp examination. Before any attempt at nucleus rotation a 3-point cortical cleaving hydrodissection as well as focal and hydrofree dissection are strongly recommended.

Reccomendations

- Detection of Capsulo cortical adhesions is important before hydrodissection
- Meticulous dilated slitlamp evaluation preoperatively is mandatory
- Capsulo cortical adhesions may be missed in non dilating pupil or dense cataract
- Can be diagnosed intraoperatively even if missed initially
- Meticulous cortical cleaving hydrodissection in presence of Capsulo cortical adhesions
  - Fluid injection after tenting of anterior capsule, close to capsular fornix
  - Mechanical lysis with cannula or cyclodialysis spatula
- Signs of successful hydrodissection
  - Fluid wave across the posterior capsule
  - Shallowing of anterior chamber
  - Prominent capsulorhexis edge
  - Release of trapped fluid from the rhexis margin when nucleus is tapped back.
- In presence of equatorial adhesions, further multiquadrant hydrodissection to be done before attempting nucleus rotation.
- Milky fluid emanating from area of adhesions could be result of lysis of adhesions
**Guidelines in Patients with Capsulo cortical adhesions**

CCA is a frequent phenomenon and often underdiagnosed

- Establish diagnosis preoperatively. (caution to be exercised in total cataract/small pupils)
- TB staining of the anterior capsule
- Meticulous cortical cleaving hydrodissection.
- Hydrofreedissection may be beneficial
- No forcible nucleus rotation
- Capsular tension ring/Injector to be kept handy

**Conclusion**

- Thorough preoperative dilated slitlamp evaluation mandatory
- Intraoperative evaluation to detect missed cases.
- Increased suspicion when lens milk visualized in preoperatively undiagnosed cases.
- A 3 point cortical cleaving hydrodissection and hydrofree dissection to be performed before attempting nucleus rotation.

**References**