Awake coronary artery bypass
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Introduction
Are you nuts? This physician probably had gone crazy! This was the initial reaction of physician community 1998 when ACAB (Awake Coronary Artery Bypass) first introduced by Karagoz. Now this has emerged as important tool in various cardiac centers.

Rationale
Performing OPCAB (Off pump Coronary Artery Bypass) under epidural anesthesia obviously decreasing invasiveness. High epidural anesthesia at T3-T4 achieves somatosensory and motor block in the chest. Need of perioperative monitoring a direct consequence of GA rather underlying disease. Elimination of GA (General Anesthesia) in CABG enables early recovery & mobilization without imposing health risk. Some patient of ACAB could be discharged from hospital on the afternoon of operation & this may ultimately lead the way towards 'Ambulatory CABG' - a dream of todays surgeons.

Benefits: Intra/postoperative
- Intraoperative benefit largely - Sympatholysis (neuroaxial blockade)
- Postoperative - Profound analgesia
- Several reports - Reduced stress response /sympathoamines
- 4 decades research failed to find anesthetic technique to attenuates stress & resultant surgical sequel
- Epidural anesthesia prevents surges of stress hormones
- Sympathetic fibres T1-T5 innervates myocardium & coronary- have role in flow
- Decreased prevalence arrythmias / HR observed in TEA during manipulation
- Cannulating T2-T3 continuous infusion of ropivocaine(0.5%)+sufentanil(1.66µ g/ml)

- Ensures sensory block from neck to abdomen with arms
- Excellent postoperative recovery
- TEA reduces hemodynamic compromise, as a result of narcotic medication before intubation in some patients

Technics developed
- To avoid extracorporeal blood contact
- To avoid mechanical ventilation / paralyzing agents
- To reduces intraoperative stress and postoperative pain (TEA)
- This allows Awake Coronary Artery Bypass graft surgery (ACAB) avoiding the drawbacks of mechanical ventilation and general anesthesia particularly in high-risk patients
- As an addition to MIDCAB (Minimally Invasive Direct Coronary Artery Bypass)/OPCAB patients with certain risk profiles, including chronic obstructive pulmonary disease, coagulation disorders and aberrant neurological conditions, get benefit from operations without cardiopulmonary bypass

Method
ACAB was introduced in January 2006, at National Institute of Cardiovascular Diseases (NICVD), Dhaka & 37 cases upto December 2007 were recorded from the registry of patients, include were:

- Significant (>70%) lesion of LAD, diagonal, Cx branches or the right coronary artery (RCA) with good patients compliance & good target vessels
- Absence of recent antithrombolytic/fibronolytic therapy
- Presence of co-morbidity did not affect patient selection

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Demographic data
In the study the number of patients was 37. Their average age was 55.3 ± 26. The gender ratio (M: F) was 12:1. Average body surface area & LVEF were 1.5 ± 0.3 & 40 ± 26.6. Number of patients with previous MI was 09 (24%), COPD was 00, Renal Disease was 06 (16.2%), Dialysis was 00, Peripheral Vascular Disease was 08 (21.6%), Diabetes mellitus was 10 (27.2%) and high risk patients were 13 (35%). All data were reviewed prospectively.

Operative techniques for ACAB
Complete median sternotomy: The chest was opened with an standard pneumatic saw and particularly careful LIMA (Left Internal Mammary Artery) dissection was necessary to avoid pneumothorax in the spontaneously breathing patient. After dissection of the LIMA in conventional technique without opening the pleural cavity, the pericardium was opened. With the aid of mechanical stabilization anastomoses were performed by standard beating-heart bypass technique (OPCAB). A wide, pledged-armed, U-shaped suture, which was placed at the acute margin of the heart and pulled toward the patient's left shoulder to expose the inferior surface of the heart.

Anesthesia for ACAB: High TEA was used. The maximum permissible block level was C6, which was monitored by a possible development of Horner syndrome. Antiplatelet therapy was stopped 5 days before surgery in all cases. In the operating room an infusion of 0.5% bupivacaine, with 2% lignocaine and fentanyl into the epidural space was started. Thus sensory block was achieved between the neck and the abdomen, including both arms. Thoracic epidural catheter was used for not only intraoperative but also postoperative pain management for 3 days. Depending on pain perception additional analgesics were used.

Operative data
Total number of cases (n=) was 37. Among them 12 cases were MIDCAB & 25 cases were OPCAB. Average procedure time (hr) was 04.46 ± 0.06. Single vessel anastomoses was 05 (13.6%), 2 vessels was 13 (35.1%), 3 vessels was 17 (45.9%), 4 vessels anastomoses was 02 (5.4%). Conversion done in 02 (5%) and Extubation in OT was 01(2.7%). Amount of chest tube drainage was 200 ± 70. Average ICU stay (d) was 1.5 ± 0.5 & hospital stay (d) was 6.5 ± 02. Need for analgesia in 3d was 02 (5%). Post-operative complication (Soft tissue infection) was 03 (8.1%). Number of anastomosis done 2.43 per patient, IMA 37 (100%), RSVG 53 (58%), Total Graft 90.

Results
5 (five) patients underwent single-vessel CABG, 13 patients underwent double-vessels CABG and 17 triple & 2 patient underwent 4 vessels CABG. 2 patients in this series required secondary intubation one after completion of internal thoracic artery harvesting because of arrhythmia (n= 1) and another for uncontrolled pneumothorax (n= 1), which was extubated in OT room after operation. Mortality of this early report is nil. No important post operative complications except soft tissue wound infection (3) were
noted. Horner syndrome was observed in no patient.

**Discussion**

TEA provides excellent conditions for off-pump/MIDCAB coronary artery bypass surgery by dilating the coronary arteries and the internal thoracic artery and by reducing heart rate and arrhythmias during manipulation of the heart. The threshold level of blood pressure remains unknown (usually a BP>70 mm Hg we considered mandatory). The operative time also seems to be shorter and this is an important factor for the awake technique. Most relevant possible disadvantage for harvesting a second conduit & a second anastomosis for the attachment of free graft to LIMA is the potential for diversion of significant LIMA flow to noncoronary/coronary vascular beds, representing some variant of a steal syndrome. We used this technique in 6 cases. In others (6) we used descending aorta for proximal anastomoses in MIDCAB revascularization of the circumflex territory in mid sternotomy (OPCAB) is in most cases difficult because of hemodynamic impairment associated with exposing the vessel. We found use of Starfish/Urchin stabilization along with verticalization of the apex provides an excellent hemodynamic tolerance. We recommend in single vessel bad proximal disease the H-graft technique for the elderly and high risk patients because it is a fast procedure that avoids intercostal retraction. In younger patients for single graft partial lower sternotomy or the rib cage-lifting technique should be used to provide patients the benefits of the internal thoracic artery graft without an ugly scar. ACAB although initially used in highly selected, compliant & mentally stable patients, it can also safely be used in all cases who are compliant to the procedure. This first report of our study demonstrate the feasibility & safety of ACAB as other workers reported. In our patients ACAB achieved excellent acceptance, even some patients persisted our team for the procedure to avoid general anesthesia and early postoperative recovery. Combination of benefits of OPCAB, a small incision, avoidance of GA, positive pressure ventilation & effective pain management may allow ACAB to compete PCI techniques. With further work & refinement of the procedure, out-patient CABG may become feasible.

**Initial impression**

- ACAB a promising adjunct to minimally invasive CABG
- May be potential use in hybrid setting
- With times AMBULATORY BYPASS not impossible at all.

**References**
