Accessory myocardial pathway mimicking an inferior myocardial infarction after major vascular surgery

EDITOR:
Pre-excitation syndromes are characterised by a shortening of the PR interval, a widening of the QRS complex and the presence of a delta-wave. These electrocardiographical changes in association with clinical symptoms define Wolff–Parkinson–White syndrome. We report a patient who underwent major vascular surgery and whose electrocardiographical changes mimicked inferior myocardial infarction. These changes fall within the framework of pre-excitation syndromes.

Case report
A 67-yr-old male was scheduled for abdominal aortic aneurysm repair. Preoperative investigation revealed no evidence of coronary disease. The routine preoperative electrocardiogram (ECG) was considered normal (Fig. 1). He was pre-medicated with midazolam 5 mg orally 1 h before surgery. Intraoperative monitoring included continuous ST–T segment analysis (lead D2, CS5 and V4; Marquette Monitor, Milwaukee), pulse oximetry and invasive arterial pressure monitoring, with a radial catheter inserted under local anaesthesia prior to induction. General anaesthesia was induced and maintained using propofol and sufentanil, as previously described [1]. Atracurium 0.5 mg kg\(^{-1}\) was administered prior to tracheal intubation and the patient was ventilated with a mixture of 50% nitrous oxide in 50% oxygen. Approximately 30 min before the end of surgery, he received propacetamol 2 g and morphine 0.1 mg kg\(^{-1}\) intravenously. Intraoperative blood loss was estimated to be 1600 mL. The postoperative haemoglobin, measured after the reinfusion of recovered blood, was 13.1 g dL\(^{-1}\).

The postoperative routine ECG (Fig. 2) shows pseudo-Q-wave in II, III and aVF derivations. The patient was awake and asymptomatic at that time. Analysis reveals a widening of the QRS greater than 0.10 s, a shortening of the PR interval at 0.12 s and the appearance of a positive delta-wave in V3, V4, V5 and V6. Inferior pseudo-Q-waves were then analysed as being in fact a negative delta-wave. Discordance between T-waves and QRS-axes, the lack of abnormality in segmental contractility on echocardiography and normal cardiac troponin I (cTnI) levels confirmed this diagnosis. Daily ECG follow-up showed a return to normal after intermittent loss of the delta-wave (Fig. 3), that may result from precarious conduction over the accessory pathway and, as such, would predict a benign prognosis in the event of the occurrence of atrial fibrillation [2].

During the entire postoperative period, the patient remained asymptomatic. Daily cTnI measurements always remained below the detection threshold. The patient had an unremarkable recovery and was discharged 10 days post-surgery. No history of syncope or clinical dysrhythmia was seen at 6-month follow-up.

Discussion
The appearance of a delta-wave is an expression of pre-excitation caused by conduction through an accessory pathway, whereas the remaining normal QRS is due to normal atrioventricular (A–V) conduction. Consequently, there are two possible explanations for the delta-wave, which appears in this case: a decrease in the conduction time through the accessory pathway or an increase in the conduction time through the normal A–V pathway.

Increased conduction time through the normal A–V pathway might be a consequence of myocardial infarction. Thus, delta-wave appearance during a high-risk period should first evoke myocardial infarction. In this case, no evidence of postoperative myocardial infarction was found and a decrease in conduction time through the accessory pathway was the most likely hypothesis.
In fact, modifications in sympathetic activity are likely to reveal [3,4] but can also mask [5] pulmonary embolism (PE) syndromes. During the perioperative period, these modifications are related to the surgical stimulus and to the depth of anaesthesia. During emergence, there is an increase in sympathetic activity. So, in addition to the surgical incision, emergence must also be considered as a high-risk period for the development of dysrhythmia, or a disorder of conduction in pre-disposed hearts.

Most often, postoperative ECG modifications evoke myocardial infarction. Yet, normality of cTnI measurements and the identification of delta-waves led us to dramatically modify our treatment strategy and made diagnosis possible without recourse to invasive procedures. As previously described [6], inferior myocardial infarction is able to be mimicked by Wolff–Parkinson–White (WPW) syndrome. T-wave and QRS-axes discordance, such as is illustrated in this case, represents a sign that could be helpful in establishing the diagnosis.

Finally the appearance of a delta-wave, in a patient without a prior history of syncope, should first alert the clinician to the possibility of myocardial damage. Yet, in this case, the unmasking of an accessory pathway appears to be the consequence of postoperative sympathetic activation. Postoperative cTnI monitoring by systematic repeated measurements [7] was particularly useful in this patient and the determination of a sequence of events and therapeutic strategies applied were dramatically altered by these negative results.

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Figure 1. Preoperative ECG.
Acknowledgement
This study was supported by departmental sources only.

Conflict of interest
No conflict of interest was declared.

References
Significance of cocaine abuse in the past

EDITOR:
The case report by Fernandez-Galinski and colleagues [1] is interesting to all practicing anaesthetists. The most ominous part of the history would seem to be the prior cocaine consumption because of its possible toxicity to the heart. Although the report states that there were no morphological injuries to the heart on post-mortem, eosinophilic myocarditis is considered a possible sequel to cocaine consumption. Cocaine is directly toxic to cardiac myocytes, and this effect is independent of route of administration or dose.

Pre-existing cardiovascular pathology would also not seem to be a pre-requisite for cocaine toxicity, although there is a suggestion that a genetic factor may be involved, giving rise to an increased susceptibility in some individuals [2]. The increased levels of circulating catecholamines associated with cocaine use also appear to damage the heart and great vessels. It is possible therefore that this patient had lesions to the electrical cardiac conduction system which did not show morphologically at post-mortem.

Why was a possible reaction to atracurium alone not investigated? The wheezing and raised tryptase after administration of this drug in this setting in conjunction with this sort of clinical history is likely to be related to atracurium. The presumed allergic reaction to atracurium could explain why a pre-injured (cocaine) cardiac conduction system failed. How rapidly was the 30 mg of atracurium given? Was there any rash on the face or chest? Was there any pre-existing or intraoperative change in the QT interval [3]. It might also have helped to have tried magnesium sulphate or amiodarone during the course of the resuscitation.

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References

Reply

EDITOR:
We appreciate Dr Wörden’s interest in our case [1] and thank him for his comments. Our patient had previous lesions including the presence of plaques in both coronary arteries but disturbances of the cardiac conduction system could not be demonstrated. Previous damage to the heart makes the resuscitation of a cardiovascular collapse difficult but an anaphylactic reaction can prevent the recovery of a healthy heart, too.

A body of evidence implicates human heart mast cells in anaphylaxis. These cells have been identified perivascularly in proximity to myocytes and in the arterial intima in human heart tissue. Administration of low concentrations of histamine and cysteinyl leukotrienes in subjects undergoing diagnostic catheterization caused significant systemic and coronary haemodynamic effects. These results indicate that the human heart can be both the site and the target of anaphylactic reactions [2].

With regard to investigation of the reaction to atracurium alone by RAST, we did not do it because in our country, there is no specific antibody to atracurium available. Therefore we tested for antibody to succinylcholine expecting to find a cross reactivity to atracurium, but obtained a negative result. In addition as we did not have enough volume of serum, we could not send it to be tested in another country.

We administered all drugs slowly because we know this simple procedure can prevent hypotension and serious reactions during anaesthetic induction. After the atracurium administration we detected a supraventricular tachycardia, a decreased $\text{SpO}_2$ and signs of bronchospasm without any rash.
Finally, in our patient the preoperative QT interval was normal although during the resuscitation period we were not able to evaluate it. It may have been useful to have administered amiodarone and magnesium as measures of last resort when the patient remained pulseless following repeated defibrillations. In addition mechanical circulatory support such as an extracorporeal circulation membrane oxygenation could have been tried.

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References

ISOFLURANE DAMAGE TO A DRAEGER PRIMUS WATER TRAP

EDITOR:
We have recently had a critical incident related to equipment malfunction which we feel would be valuable to bring to the attention of others.

We induced a 33-yr-old ASA Grade II female in the anaesthetic room for a laparoscopic cholecystectomy. Once we had transferred the patient to theatre and connected the monitors, we noticed unusually low end-tidal values for oxygen, nitrous oxide, isoflurane and carbon dioxide, despite normal inspiratory values. The condition of the patient and the connections was assessed and found to be satisfactory. We then noticed the water trap was cracked (Fig. 1). Replacing the water trap led to the return of normal values and the case continued uneventfully. We feel the damage to the water trap had occurred during spillage of isoflurane whilst filling the Vapor 2000 vaporizer, causing it to crack and leak.

We received a report from the manufacturer which stated that a damaged water trap will be detected during the Primus Power-On Self Test. To prevent ‘dripping’ of anaesthetic agent onto the water trap they recommended following certain points during the filling process. First, the filling adaptor should be tightly locked at the agent’s bottle (and if old filling adaptors without check valves are being used, they should be changed to the new version, available since 1998, to speed up the filling process). Second, the filling adaptor should only be fastened hand tight, without applying too much force, to avoid twisted or damaged seals inside the vaporizer’s filling system. If the filler plate seals show signs of wear, they should be replaced with new seals. Finally, only original Draeger filling adaptors should be used, to prevent damage to the seal inside the vaporizer’s filling system, resulting from the use of unapproved filling adaptors. If the above points are followed, there is no need to remove the vaporizers from the Primus during the filling process, as the keyed filling system is designed to be leak proof. To prevent gas leakage resulting from the above procedure, a leak test should be performed after a change or filling a vaporizer.

Similar problems have been reported by Vemmer and colleagues [1], and at that time the manufacturer...
recommended removing the vaporizer for refilling. However, the advice we have received which is more recent states this is not necessary, as does the Association of Anaesthetists of Great Britain and Ireland [2].

We have reported this incident to the Medicines and Healthcare products Regulatory Agency in the UK and have distributed this information amongst our department to increase awareness of this potential problem.

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Lidocaine vs. mepivacaine for peribulbar anaesthesia in cataract surgery: a randomized double-blind study

EDITOR:
Anaesthesia for cataract phacoemulsification surgery concerns a very large number of patients. Peribulbar anaesthesia appears secure and appropriate for day-stay surgery. The choice of local anaesthetic is mainly designed to rapidly restore the patient’s visual capacities. Lidocaine and mepivacaine are the more frequently used agents. They have similar pharmacokinetic characteristics: rapid onset, intermediate duration of action and equivalent intensity of motor block [1,2]. The major difference pertains to the cost of mepivacaine which is ten times more expensive than lidocaine. The aim of our randomized double-blind study was to compare lidocaine and mepivacaine in ambulatory cataract surgery with respect to the quality of akinesia and analgesia, the patient’s and surgeon's comfort and speed of visual recovery.

After obtaining approval from the local ethics committee and written consent, 60 patients scheduled for elective cataract phacoemulsification under peribulbar anaesthesia were included in this randomized double-blind study. Exclusion criteria were age under 18, allergy to local anaesthetics and contraindications to peribulbar anaesthesia as only one eye, axial globe length greater than 27 mm, anticoagulant medication, local infection, recent ocular surgery or trauma, deafness without corrective appliance, mental deficiency, senility, Parkinson disease, chronic cough, claustrophobia or psychiatric pathology.

After oral premedication with hydroxyzine (1 mg kg⁻¹) and oxybuprocain eyewash instillation, a peripheral intravenous (i.v.) cannula was inserted. Patients were randomly assigned using a random number table to receive either mepivacaine 2% (Group M) or lidocaine 2% (Group L). For each patient the solution was prepared out of the room by an independent anaesthetist nurse in a 20 mL syringe. The peribulbar injection was similar to that described by Davis and Mandel [3]. A 25-G, 22 mm short-bevelled needle was inserted into the inferotemporal site along the orbital floor through the lower lid skin and local anaesthetic was injected until fullness of the peribulbar cavity (superior eyelid closed) with a maximum of 10 mL. Beyond 10 mL of local anaesthetic without complete eyelid closing, a superonasal injection was performed. The total volume of injected solution was noted. All the punctures were done by the same anaesthesiologist, experienced in this technique. An ocular pressure of 30 kPa by Honan balloon was applied for 10 min.

Akinesia of the globe and eyelids was graded by another blinded anaesthetist at 1, 3, 5, 10, 15, 60, 90, 120, 150, 180 and 360 min after the end of injection (the Honan balloon was removed to do the early assessments). A 12-point akinesia scale was used: 0: no block; 1: partial akinesia; 2: total akinesia for each of the four rectus muscles; the levator palpebrae and the orbicularis oculi. If akinesia was judged insufficient after 10 min (score < 7), 4 to 6 mL of the same solution could be re-injected. Akinesia

References
score was used as the main index of the quality of anaesthesia. Onset time was defined as the time elapsed from the end of injection until the best akinesia score was reached. Recovery time was defined as the elapsed time from the end of injection to complete recovery of the motor block. The need for supplemental injection was noted.

The analgesia score was recorded every 10 min during surgery using a verbal scale from 0 to 2 (0: no analgesia requiring re-injection during surgery; 1: partial analgesia requiring oxybuprocain eyewash instillation during surgery; 2: total analgesia). Intraocular pressure was measured by the surgeon before and 10 min after injection. Age, gender, weight, side of intervention, axial length of the globe and duration of surgical procedure were recorded. Arterial pressure, heart rate, and SPO₂ were recorded before the block, 5 min after injection and every 10 min during surgery. Surgical conditions were determined by a 3-point scale (3: good; 2: medium; 1: poor). A visual analogue scale from 0 (not satisfied) to 10 (very satisfied) was used to evaluate patient satisfaction at the end of surgery.

Results were expressed as mean ± standard deviation. U-test and Wilcoxon signed rank sum test were used as appropriate to compare the values between the two groups. P < 0.05 was considered significant. The number of patients to be included in our study was calculated to show a 30% difference in akinesia score between the two groups [2]. Sixty patients were required to provide 80% power at the 0.05 level.

The population characteristics were similar in both groups. The duration of surgery was 36 ± 16 min for Group L and 43 ± 13 min for Group M (not significant). Haemodynamic parameters remained stable throughout the study without any difference between groups. The total volume of solution injected was similar in both groups (L 9.8 ± 3.4 mL vs. M 9.7 ± 2.8 mL). In Group L, 10 patients (33%) needed supplemental injection compared to 9 (30%) in Group M (not significant). Solution administration was not associated with any significant elevation of intraocular pressure: 16.3 ± 3.4 kPa for L vs. 15.9 ± 2.6 kPa for M at 0 min and 17.7 ± 5.3 kPa for L vs. 16.6 ± 5.2 kPa for M at 10 min. Figure 1 shows the akinesia score. Onset of the motor block occurred in 6.9 ± 2.3 min for L and 6.7 ± 2.2 min for M (not significant). Recovery of akinesia was faster with L. At 120 and 150 min, the akinesia score was significantly lower with lidocaine than mepivacaine 4.7 ± 2.9 vs. 6.8 ± 3.5 (P = 0.02) and 3.7 ± 3.4 vs. 6.2 ± 3.3 (P = 0.01) respectively. Intraoperative analgesia was excellent (score = 2) in both groups. Only one patient in each group needed supplemental topical analgesia. Overall, surgeons were comfortable to operate and patients were satisfied of their anaesthesia without any difference between groups.

This study aimed to compare lidocaine 2% and mepivacaine 2% in peribulbar block for ambulatory cataract surgery. Quicker recovery of eye muscle contractility was observed 2 h after anaesthesia with lidocaine compared to mepivacaine. In ambulatory

![Figure 1](image-url)

**Figure 1.** Akinesia score after injection of lidocaine and mepivacaine. Data are presented as mean ± SD. *P < 0.05, U-test.
cataract surgery, local anaesthetic must have a rapid onset of motor and sensory block, a length of action adapted to surgery and a fast recovery of visual acuity. Previously, lidocaine–bupivacaine was the most common solution although it provided an excessive duration of anaesthesia [1,2]. Similar criticism can be levelled at ropivacaine and bupivacaine injected alone [4,5]. Therefore lidocaine and mepivacaine are now recommended for day-case cataract surgery because they have a short duration of action and they are recognized for the quality of their motor block. Our findings confirm these characteristics. Furthermore, the conditions of local anaesthesia were good. The volume required and the rate of re-injection did not differ between the two components. Similar results were previously reported for lidocaine [1] and for mepivacaine [2] used at the same concentration. The injection with required compression was not associated with deleterious increase of intraocular pressure. This explains at least in part why the majority of surgeons in our study estimated that technical conditions for surgery were good and only one patient needed supplemental topical anaesthesia in each group. Motor block was observed in less than 7 min and lasted throughout surgery in both groups. Even if akinesia is not absolutely mandatory for an experienced surgeon, it has been reported to improve surgical condition [6]. In the context of day-case cataract surgery, both lidocaine and mepivacaine provide a rapid onset of motor block but recovery is longer for mepivacaine. This residual motor block may increase ocular vulnerability and is associated with persistent diplopia which delays patient discharge. Being cheaper than mepivacaine (0.48 vs. 5.30 Euros at our institution), lidocaine may be preferred for peribulbar anaesthesia in day-stay cataract surgery.

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