Significant Effects on the Blood Pressure of an Apparently Trivial Atrial Dysrhythmia

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The deleterious circulatory effects of cardiac dysrhythmias are a subject of legitimate concern. This concern justifies the popularity of monitoring devices for the purpose of prompt detection of dysrhythmias. However, serious disturbances in blood pressure may develop because of atrial dysrhythmias so trivial as to escape detection by means of ordinarily employed audio-visual monitors. The author has observed 17 such episodes during the past nine years. Because the sequences of events were very similar, one case only is described in detail but the discussion is applicable to all.

REPORT OF A CASE

A 63-year-old woman was undergoing a modified left radical mastectomy. The electrocardiogram, monitored from a single bipolar lead, was displayed on an oscilloscope by means of a beam moving at the speed of 25 mm/sec; an audio signal, triggered by the QRS complex, provided continuous information about heart rate and rhythm; the blood pressure, monitored via a #18 Teflon cannula in the brachial artery connected to a strain gauge, was also displayed on the oscilloscope; a continuous record of the blood pressure and of the electrocardiogram was produced on line and in real time by means of a ten-speed polygraph.

Preoperative evaluation of the patient, including EKG, revealed no major systemic disease. In the operating room, the preanesthetic electrocardiogram reading was regular sinus rhythm. Preanesthetic medications consisted of 0.8 mg atropine, administered i.v. immediately before loss of consciousness, which was accomplished by means of 350 mg thiopental. Topical anesthesia of the airway (10.0 ml of 2.0 per cent lidocaine) allowed insertion of an endotracheal tube without the benefit of muscle relaxants. Anesthesia was then induced and maintained with a high-flow halothane-oxygen mixture in a semiclosed system.

The procedure had continued uneventfully for about 90 minutes when, without the benefits of prodromal signs (panels A and B of figure 1), wide and unpredictable swings in the "condensed" pattern of the blood pressure became evident. Over a short period, while the blood pressure disturbance continued, blood pressure fell noticeably without there having occurred any significant blood loss and without any other explanation for the overall behavior of the blood pressure. At this time neither the electrocardiographic signal displayed on the oscilloscope nor the audio signal, triggered by the QRS complex, gave any indication that rhythm disturbances had occurred. Also, inspection of the arterial blood pressure pattern, displayed on the oscilloscope at a speed of 25 mm/sec, failed to convey any information about the instability of the blood pressure, as shown in the slow-speed polygraph record. At this time, among the various steps taken to elucidate the nature of the disturbance, the electrocardiographic signal was greatly amplified and the recording speed was increased, which led to the discovery that the cardiac pacemaker, while still in the atria, had shifted (panel D of figure 1).

Following an unsuccessful attempt to re-establish a regular, albeit faster, sinus rhythm via administration of atropine, halothane administration was discontinued and methoxyflurane administration initiated. This step was followed by a return to regular sinus rhythm and stabilization of the blood pressure (panels C and E of figure 1).

The remainder of the operation was completed without further difficulty. The patient's postoperative hospital stay was uneventful and free of episodes of dysrhythmia.

COMMENTS

The major items for discussion are the true nature of the disturbance, its frequency, its long- or short-term effects, its possible causes, and finally, reliable detection methods.

The disturbance is a pronounced instability of the blood pressure associated with, and most likely secondary to, an electrocardiographic disturbance that is limited to the atria. Even though the gross appearance of the electrocardiogram is that of an ordinary nodal or junctional rhythm, the essence of the dysrhythmia is the fact that the P-R interval changes continuously and irregularly from beat to beat, while the gross heart rate remains unchanged.

Since the inception of routine simultaneous, automatic and continuous monitoring and recording of the electrocardiogram and the blood pressure,1 2,500 patients have been thus monitored, and a special log has been kept of all observed unusual events. A careful search of that log reveals that this disturbance was noticed in 17 patients (0.7 per cent). The search failed to yield any evidence that the sudden transition to a true nodal or junctional rhythm ever resulted in a similar disturbance in blood pressure pattern.

The long- or short-term effects of this disturbance are difficult to assess because, with prompt and aggressive management, a stable blood pressure pattern and a regular sinus rhythm were re-established in every patient in less than 15 minutes (in 14 patients i.v administration of atropine, 0.5 to 2.0 mg, proved sufficient, and in three patients it was necessary to change the anesthetic agent).

The causative or facilitative roles of preanesthetic medications or anesthetic agents are also difficult to

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Fig. 1. Blood pressure recordings (panels A, B, and C) from a #18 Teflon cannula in the right brachial artery, calibration and time constant as indicated. Electrocardiographic recordings (panels D and E) from a single bipolar lead (right shoulder to left iliac crest), calibration and time constant as indicated. The two records were made simultaneously on a ten-speed polygraph. Note the sudden onset of irregularities in the blood pressure pattern in A and B. No abnormalities having been evident in electrocardiogram, this signal was greatly amplified, and a 30-second strip was obtained at high paper speed (between A and B). A short segment of the high-speed-cum-high-amplification electrocardiogram is shown in D. When administration of atropine failed to re-establish regular sinus rhythm, halothane anesthesia was discontinued and methoxyflurane administration begun. In about 5 minutes, a regular sinus rhythm was observed again (E), and the blood pressure pattern became regular again (C).

assess. All patients received atropine IV immediately prior to induction of anesthesia, in amounts sufficient to increase the baseline pulse rate by 20 per cent or more. Though the disturbance was most commonly observed during halothane anesthesia, it was also seen during enflurane and methoxyflurane administration. Finally, the disturbance does not appear to be associated with patient age, sex, or weight, or stage of anesthesia.

Detection is a vexing issue. As noted, recognition of the disturbance in blood pressure pattern invariably preceded and led to the discovery of the dysrhythmia. Thus, monitoring and recording of intra-arterial blood pressure by means of a slow-moving recorder would appear to offer the only reliable means of detecting the dysrhythmia.

For practical purposes, once a dysrhythmia is detected, then the issue is a decision about urgency or need for therapy. Probably it is in an effort to offer guidance along these lines that labels such as “significant” or “serious,” as opposed to “non-serious” have been suggested; by such criteria the dysrhythmia reported herein would have to be classified “non-serious.” However, the acid test of any dysrhythmia is its effect on the peripheral circulation, and within this context one would be hard pressed to classify the observed changes in blood pressure pattern as insignificant. It is likely that no dysrhythmia is insignificant until so proven.

Summary

Continuous automatic monitoring and recording, at slow paper speed, of the intra-arterial blood pressure revealed serious disturbances in blood pressure in a small number of patients undergoing general anesthesia. In all instances, the underlying mechanism was found to be a rhythm disturbance so trivial as to have escaped earlier detection by means of conventional audio-visual monitoring. The practice of routine monitoring and recording of the intra-arterial blood pressure would appear to receive support from these findings.

References