of the larynx. We suggest that this abnormality was acquired or worsened as a result of the patient's stiff joint syndrome as his trachea had been intubated, albeit with difficulty, 5 years prior to our attempts, and his clinical picture fits every major feature of the syndrome. We further suggest that as a result of increased longevity due to renal dialysis and transplantation, anesthesiologists may be presented with an increasing number of patients with this problem. Besides intubation difficulties, the potential for problems monitoring neuromuscular-junction function by ulnar nerve stimulation and decreased pulmonary elasticity should be kept in mind when managing the anesthetics of these patients.

In conclusion, intubation of this patient with long-term JODM, microvascular disease, finger–joint contactures, and nonfamilial short stature was deceptively difficult due to limitation of movement at the atlanto–occipital joint.

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Usefulness of the Post-aspirin Bleeding Time

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The preoperative assessment of patients taking aspirin and other drugs with "antiplatelet activity" continues to be a problem. Some authors indicate clinically significant increases in perioperative blood loss in such patients,[1–3] while others do not.[4–7] A preoperative bleeding time is often recommended for patients who have taken aspirin, presumably to assess the adequacy of platelet function and hemostasis.[8–10] However, the following case illustrates that the post-aspirin bleeding time is not always a reliable indicator of platelet function or hemostatic capability.

Report of a Case

A 12-year-old boy was scheduled for median sternotomy and pulmonary wedge resection to excise a metastasis originating from an osteogenic sarcoma of the right radius. He had received 3,000 rads to the primary tumor and had undergone four courses of chemotherapy with methotrexate. Four days previously, the patient underwent resection of the right distal radius and ulna, and the right scaphoid and lunate with replacement by a vascularized fibular bone autograft. The 15-h anesthetic consisted of oxygen, nitrous oxide, halothane, and morphine, with an estimated blood loss of 800 ml, which had been replaced with packed red blood cells. Postoperatively the patient was treated with aspirin 650 mg bid and dipyridamole 25 mg bid to decrease the chance of thrombosis at microvascular anastomotic sites.

A preoperative review of systems elicited no personal or family history of bleeding or easy bruisability. Aspirin and dipyridamole had been discontinued 24 and 72 hours earlier, respectively. Preoperative prothrombin time, partial thromboplastin time, and platelet count were normal. A bleeding time was performed that evening using the Simplate® (General Diagnostics, Morris Plains, New Jersey) device with venostasis and horizontal incision as described by Mielke.[11] The bleeding time equaled 17.5 min, with normal being less than 8 min. The morning of surgery, some 12 h after the initial bleeding time, two additional bleeding times using the same technique were performed, which were within the normal range, each less than or equal to 4.5 min. The patient had been premedicated with orally administered pentobarbital and underwent an uneventful induction of anesthesia by inhaling halothane. However, upon sternal skin incision, 50 ml of blood were lost. As a result, surgery and anesthesia were not continued due to inadequate hemostasis. A specimen of blood for platelet function studies was collected in the recovery room. The platelets had normal responses to adenosine diphosphate, epinephrine, collagen, and ristocetin. A work-up for von Willebrand's disease was negative. Aspirin and dipyridamole therapy was not reinstituted.

Two weeks later, with a preoperative bleeding time equal to 5.5 minutes, the procedure was attempted again with successful resection of a right hilar pulmonary metastasis. Hemostasis was judged to be adequate. Estimated blood loss equaled 225 ml, and postoperative recovery was unremarkable.

Discussion

There are several factors that may make the post-aspirin bleeding time an unreliable predictor of operative he-

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mostasis. First is the matter of technique. The presence of venostasis (achieved *via* a blood pressure cuff), the location, and the direction of the incision can each greatly affect the result. Depending on technique, the bleeding time can be completely unaffected by aspirin (vertical incision, no venostasis) or greatly prolonged,[11] (horizontal incision, cuff inflated to 40 mmHg). Secondly, although the bleeding time will return to within the normal range 48 to 72 hours after a single dose of aspirin,[5,12] platelet function (as assayed by *in vitro* aggregation studies) may take many days to return to normal. The response to collagen is normal in 4 days, epinephrine in 5 days, and adenosine diphosphate in 6 days. Serum thromboxane B_2 levels (a metabolite of thromboxane A_2) do not return to normal for 7 days.[5,11] Thus, aspirin-induced platelet dysfunction may exist in the presence of a normal bleeding time. Further, the bleeding time must, in part, be determined by factors other than those assayed by platelet aggregation studies. Third, although mean bleeding times are clearly elevated in groups of patients given aspirin, bleeding times of many individual patients receiving aspirin may be within the normal range.[11-13] In one study, 37% of subjects given 975 mg of aspirin had bleeding times within the normal range 2 h later.[14] Knowledge of the baseline (pre-aspirin) bleeding time compared with the post-aspirin value could be helpful in determining if platelet function has returned to normal. However, in clinical practice, baseline bleeding times are almost never known. Thus, a "normal" bleeding time after aspirin in no way guarantees "normal" platelet function. However, an abnormal bleeding time apparently does not reliably indicate ineffective perioperative hemostasis after aspirin. Three recent studies could find no correlation between prolonged preoperative bleeding times induced by aspirin and increased operative blood loss.[4-6]

Aspirin in doses greater than 325 mg results in the complete and irreversible acetylation and inhibition of platelet cyclooxygenase.[15-17] This inhibition prevents the synthesis of thromboxane A_2, which facilitates secondary platelet aggregation and release reactions that are used to determine platelet function *in vitro*.[18] However, platelet adhesion to damaged endothelial surfaces with consequent primary hemostatic plug formation is not dependent on prostaglandins.

Thrombin generated at the site of the vascular lesion interacts with a specific platelet receptor to cause platelet aggregation and secretion independent of the prostaglandin pathway.[19,20] Platelets from patients taking aspirin continue to have near normal interactions with subendothelium. There was no attenuation of adhesion, aggregation, or thrombus formation when noncitrated native blood was used in an experimental preparation.[21] Thus, an adequate, although potentially fragile, hemostatic plug may form within a normal time period (*e.g.*, normal bleeding time) containing platelets that are unable to synthesize thromboxane A_2 or undergo secondary aggregation and release reactions. Such plugs are likely to be adequate hemostatic barriers for smaller vascular lesions such as those introduced to perform a bleeding time or created in many operative procedures. When or if secondary aggregation and release reactions may be of importance to ensure adequate perioperative hemostatic plug formation is unknown. Finally, the response of the vessel itself to injury may be important in achieving hemostasis. Intravenous nitroglycerin prolongs the bleeding time, despite normal platelet aggregation and prostaglandin levels. Such prolongation may result from changes in vascular tone.[22]

With regard to the patient described in the "Report of a Case," which bleeding time was "right"? Retrospectively, the latter two bleeding times correctly predicted normal *in vitro* platelet function. The patient probably could have had his operation without excessive blood loss. However, due to the unpredictable relationship between bleeding times, platelet function, and operative blood loss (see "Discussion") no one in the operating room, in the face of clinically inadequate hemostasis in a patient at risk of platelet dysfunction, felt it wise to proceed, despite two "normal" bleeding times.

This case serves to demonstrate the great difficulties that exist currently in determining the status of aspirin-induced platelet dysfunction preoperatively and whether aspirin-induced platelet dysfunction is of major hemostatic importance in noncardiovascular surgery. The need for further investigation is clear as the list of drugs that affect platelet function and bleeding time is very long and includes: dipyridamole,[23] propranolol,[24,25] nitroglycerin,[22,26] calcium-channel-blocking drugs,[27] nonsteroidal anti-inflammatory agents,[28,29] antibiotics,[30] and halothane.[31] Likewise, the potential for unanticipated interactions increases. The need exists for a cost-effective, sensitive, and specific predictor of intraoperative hemostatic capability. The bleeding time, our current tool, does not always meet this need.

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