Venous thromboembolism and orthopaedic surgery

Pulmonary embolism is a major cause of death in patients undergoing surgery. It accounts for 10% of hospital deaths, and 0.9% of all admissions (Kawinski and Svendsen 1989; Sandler and Martin 1989). Without prophylaxis, deep-vein thrombosis (DVT) occurs in 40% to 80% of patients undergoing hip or knee arthroplasty and the incidence of pulmonary embolism is 1% to 10%. DVT is the commonest cause of readmission to hospital after total hip replacement (Seagroatt et al 1991). Its incidence in patients with multiple trauma is largely unknown, but it has been reported to be as high as 67% in those who have fractures of the lower limb as well as other injuries (Kudsk et al 1989).

The recent publication of the findings of the Thromboembolic Risk Factors (THRIFT) Consensus Group (1992) has highlighted the need for awareness of the problem and for the use of prophylaxis in orthopaedic patients. The issue has been complicated, however, by the simultaneous introduction of a number of new prophylactic agents and the accompanying commercial pressure to adopt one of these instead of older methods. Among orthopaedic surgeons there is, as yet, no clear consensus on which regime is best (Laverick, Croal and Mollan 1991).

The choice of the ideal prophylactic agent must be based on an understanding of the natural history of the disease in orthopaedic patients. DVT after total hip replacement has been shown to be resistant to the methods of prevention normally used in other surgical specialties (Salzman and Harris 1976), suggesting that these methods do not act effectively on the thrombogenic process in orthopaedic patients. Knowledge of the natural history has advanced little since the initial thesis of Virchow (1859), largely because of the absence of a non-invasive, repeatable detection system. The relative contributions of injury to the vessel wall, hypercoagulability and venous stasis have been studied experimentally in detail. Stamatakis et al (1977) suggested that torsion of the femoral vein during dislocation of the hip was the main factor producing injury to the vein wall and hence proximal femoral thrombosis. This idea was superseded when improved venographic studies by Kålebo et al (1990) showed that thrombi after total hip replacement were almost always associated with a venous valve cusp or sinus. Sevitt (1974) had already demonstrated that proximal venous thrombi can form on intact endothelium, and Thomas (1985) showed that even gross injury to the vessel wall is a poor stimulus to venous thrombosis.

The use of chemical agents which reduce the coagulability of whole blood is based on the assumption that there is a period of hypercoagulability after major surgery or injury. Consequently, changes in plasma levels and activity of certain blood coagulation and fibrinolytic markers have been studied in total hip replacement (Gitel et al 1979; Eriksson et al 1989). There is, however, little evidence of a correlation between the changes observed in these markers after surgery and the subsequent development of DVT. Defective fibrinolysis, however, has been shown to be associated with the presence rather than the development of DVT (Browse et al 1977) and low preoperative levels of plasminogen activator inhibitor have been implicated in thrombosis after total hip replacement (Paramo, Alfaro and Rocha 1985; Rocha et al 1988; Eriksson et al 1989). Studies to date indicate therefore that although there are changes in both coagulation and fibrinolysis after surgery, they are not the major factors in thrombogenesis. Pre-existing defects in coagulation inhibitors (antithrombin III) and defective fibrinolysis may be more important in certain patients. If such patients could be identified before surgery, they could be treated with anticoagulant prophylaxis. Such a group would be unlikely to have bleeding complications.

Vascular stasis is a recognised factor in thrombogenesis (Thomas 1985). During orthopaedic operations stasis is often complete; this is so when a tourniquet is used or during the period of dislocation of a hip. General and spinal anaesthesia and postoperative immobility all interfere with the normal calf muscle pump and cause reduced flow in the deep veins. The site of initiation of thrombosis has been correlated with those of maximum stasis both venographically and at post mortem (Paterson and McLachlin 1954; McLachlin et al 1960; Kålebo et al 1990). It has only recently been possible to study the effect and duration of venous stasis, but it wouldappear to be prolonged and may even contribute to thromboses.
which occur after discharge from hospital (McNally and Mollan, p. 640 of this Journal).

Because of our incomplete knowledge of the natural history of this common condition a plethora of preventive methods has evolved. The physical methods, such as compression stockings, pneumatic compression, calf muscle stimulation and foot pumps, seek to prevent stasis; the chemical agents, such as warfarin, dextran, heparin and low-molecular-weight heparin, are intended to inhibit procoagulant activity during and after surgery. All these methods have been shown to reduce the risk of thrombosis when compared with placebo, but the chemical agents all carry the risk of bleeding complications.

There is now no doubt that all patients undergoing major orthopaedic surgery should have some form of prophylaxis (Roberts 1986; THRIFT 1992) and numerous studies have shown that it is cost-effective. Furthermore, all patients with previous thromboembolism or malignant disease and all those over 40 years old should be regarded as high-risk cases regardless of the magnitude of the surgical procedure.

Recommendations as to the choice of prophylaxis, based on the cumulative evidence of recently published studies, are given in the THRIFT report. Attention to simple prophylactic measures, such as discontinuing oral contraceptives before surgery, early postoperative mobilisation, the use of spinal anaesthesia and the choice of operative technique, is advocated. There is some indication that the posterior approach to the hip carries a lower risk of proximal thrombosis (Gallus, Raman and Darby 1983). In our centre, the combination of spinal anaesthesia, the posterior approach, early mobilisation, intra-operative electronic stimulation of calf muscles and perioperative dextran 70 (Macrodex; Kabi Pharmacia, Milton Keynes, UK) has reduced the incidence of proximal DVT in total hip replacement to 1% (as detected by strain-gauge plethysmography and venography).

Both low-molecular-weight heparin (LMWH) and adjusted-dose standard heparin have given effective risk reduction in a number of studies (THRIFT 1992). The meta-analysis of Nurmohamed et al (1992) suggested that LMWH was better than standard heparin in hip surgery. Their study, however, included data from trials in which LMWH was compared with standard heparin used with dihydroergotamine and it has been shown that, in total hip replacement, the combination is less effective than heparin alone (Gallus et al 1992). Recent trials, in total hip replacement, have shown no difference in efficacy between LMWH and standard heparin alone (Eriksson et al 1991; Leyvraz et al 1991; GHAT 1992) and at present there is no convincing evidence that LMWH is superior (in orthopaedic surgery) in regard to bleeding complications. It does have the advantage of a once-daily injection, but it is more expensive. Initial studies with the A-V Impulse foot pump (Novamedix, Andover, UK, distributed by Howmedica International) in total hip replacement and hip fracture have been encouraging (Fordyce and Ling 1992; Stranks et al 1992). In patients with proximal femoral fractures, adjusted-dose warfarin and dextran 70 have both been shown to be moderately effective; the latter reduced the risk of fatal pulmonary embolism in this group. In total knee replacement, the lack of adequate trials of prophylaxis makes recommendation extremely difficult. Low-dose warfarin, intermittent pneumatic compression and dextran 70 may all be of use.

Interestingly, the question of duration of prophylaxis is not firmly answered in the THRIFT (1992) report. The occurrence of DVT shortly after discharge from hospital in patients who did not have thrombosis on the day of discharge is well established (Tremaine, Choroszy and Menking 1991; McNally, Brown and Mollan 1992).

The ideal prophylactic agent for orthopaedic and trauma patients is not yet available; all methods leave a 'residual incidence of thromboembolism'. Up to one-third of patients undergoing hip surgery may still develop DVT despite prophylaxis (Lassen et al 1991; GHAT 1992; Jørgensen et al 1992) and these thromboses are often asymptomatic. Sandler and Martin (1989) reported that only 3% of patients who had fatal pulmonary embolism had been suspected of having DVT before death. The detection of asymptomatic postoperative DVT is difficult; clinical examination is no help and venography is too invasive to be used as a screening test. In orthopaedic patients who have symptoms and signs of DVT, diagnosis by a new non-invasive method of strain-gauge plethysmography has been shown to be highly accurate for the detection of proximal thrombosis (Laverick et al 1992; McNally et al 1993). This method, and duplex ultrasonography, are both under investigation, and it appears that strain-gauge plethysmography may be as accurate in asymptomatic patients as it is in those with symptoms (McNally et al 1992).

In summary, the wider use of prophylaxis is advocated in orthopaedic surgery. The choice of agent must depend on local experience and the degree of risk. In every orthopaedic centre the policy for prophylaxis should be formulated and written down, defining the risk groups and the method to be used in each. The present paucity of information on the prevention of DVT in total knee replacement merits further study. Improvement in patient care, by early detection and treatment, could be achieved by the implementation of non-invasive screening and wider evaluation of existing screening techniques is urgently required.

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REFERENCES


Schistosomiasis

Schistosomiasis, also known as bilharziasis, is thought to affect some 200 million people in 73 countries throughout the world (Jordan and Webbe 1982). It is strange therefore that so common a disease, with such widespread effects on the systems of the body, should have been so rarely reported as a cause of musculoskeletal lesions. In this issue (p. 602) Fachartz, Kumar and Hilou describe a case of probable schistosomal infection of the hip but their search of the literature failed to discover a similar case.

The three most common species of trematode are Schistosoma haematobium, S. mansoni and S. japonicum; all have man as their definitive host but each has a different freshwater snail as its intermediate host. S. haematobium is confined to Africa and the Near and Middle East; S. mansoni is found in Africa, Saudi Arabia, the Yemen, South America and the Caribbean; and S. japonicum is found only in the Far East.

The adult schistosome worms, both male and female, live in human mesenteric, portal and vesical veins, and their life cycle consists of alternate generations each in its own host. The miracidium hatches from the egg and invades the freshwater snail from which the cercariae are released and invade the human host. They penetrate

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