The principal of regional perfusion using cytostatic drugs resulted from a study by Klopp et al. (1950) who found that pain was alleviated and tumour size reduced when small doses of nitrogen mustard were injected into the regional arterial blood flow. The best results were obtained when venous return from the area involved was blocked. In 1956, the coming together of a cardiothoracic, a plastic and an oncological surgeon in the Department of Surgery at Tulane University, New Orleans, Louisiana, USA, resulted in the introduction of a new concept in the treatment of regionally recurrent malignant disease. It was postulated that if an area of the body could be isolated from the systemic circulation and sustained by an extracorporeal circuit utilizing a heart lung machine, it would be possible to produce a high concentration of a chemotherapeutic agent in the isolated perfusion circuit limited only by the toxicity to the sensitive structures within that area. At the end of the perfusion, the unbound drug could be removed, the circulation restored and any excisional surgery carried out as necessary. The patient would benefit by a maximal tumour chemotherapeutic exposure in the treated area while being protected from systemic toxicity. Ryan et al. (1957) developed techniques in the laboratory for isolation perfusion of the hind limb, mid gut and liver of a dog. It was found that the dosage of nitrogen mustard tolerated in the hind limb was the equivalent of a single whole body systemic dose.

In 1957, a 76-year-old man presented with recurrent melanoma of the left lower limb consisting of more than 80 cutaneous satellites following a previous wide excision of a melanoma of the ankle and superficial groin dissection in 1955. Perfusion of the left lower leg was carried out with a home made, De Wall-type bubble oxygenator and a Sigma motor pump (Creech et al. 1959). Melphalan (120 mg) was used in the circuit and over the period of the next several months, a gradual remission of the satellites occurred. Total clearing of the recurrent melanoma followed. The patient survived 16 years, dying free of disease aged 92. This unique response stimulated the development of the clinical use of isolated perfusion with chemotherapy for recurrent regional malignancy.
Technique of Isolated Limb Perfusion

Upper Limb Perfusion (Fig. 10.1)

An incision is made in the subclavicular region. The clavicular and sternal portions of the pectoralis major are separated and the pectoralis minor is detached from the coracoid process. This exposes the intermediate and superior levels of the axilla. The latter are radically dissected and all collateral vessels are ligated. The patient is then fully heparinized following which first the axillary vein and then the artery are cannulated. An Esmarch’s bandage is then tightened around the shoulder, anchored with Steinman pins inserted into the subcutaneous tissue around the root of the limb. After one hour perfusion, and subsequent washout of the vasculature with approximately 2 litres of Hartmann’s solution, the tourniquet is removed, the cannulas are taken out of first the artery and then the vein and the arteriotomy and then the venotomy are repaired with continuous Prolene sutures.

A full axillary block dissection is performed as it is extremely difficult to assess this region following isolated limb perfusion. Perfusion is carried out for recurrent disease usually with three drugs: melphalan, actinomycin D and nitrogen mustard. If a repeat perfusion is being performed then vindesine or DTIC are used.

Fig. 10.1. Upper extremity isolated limb perfusion. Reproduced from Rosin (1991), with permission.