LARGELY THROUGH THE TRADITIONAL TEACHING and the clinical experience of surgeons, it has been recognized that the application of an arterial tourniquet around a limb was not dangerous if not prolonged for over an hour and a half. Consequently, the procedure has been widely accepted and used in all kinds of limb surgery, from the conventional orthopaedic operations to the delicate and time-consuming functional reconstructions of the hand, where the advantages of a bloodless field are undeniable. Although it is a relatively infrequent complication, tourniquet paralysis is such a disaster to all concerned that it warrants the careful consideration of the medico-surgical team. Several possibilities have been considered to explain these paralyses. Some investigators agree that its occurrence is due to a mere mechanical abuse exerted by direct tourniquet pressure upon the frail nerve structures. Others consider a more important factor to be the ischaemic condition produced in the limb by the acute interruption of blood flow.

The purpose of the investigation discussed here was neither to settle the question once and for all, nor to raise opposition against the use of tourniquets during surgery. Nevertheless, while reviewing the literature on the subject, we noticed that up to now very little emphasis had been directed to the metabolic changes occurring in the ischaemic limb. Such changes might be of considerable importance in the pathogenesis of tourniquet accidents, especially when it is realized that nerve function and integrity are critically dependent upon their environmental chemical homoeostasis. It appeared of interest, therefore, to investigate the biochemical disorders induced in the surroundings of the nerves under conditions of circulatory arrest, such as are produced by tourniquets.

**Material and Methods**

These studies were conducted both in man and in monkeys. One of us (R D) allowed a pneumatic tourniquet to be inflated over his left arm at a pressure of 250 mm of mercury for half an hour. In order that peripheral venous blood might be intermittently drawn from the distal part of the limb and analyzed, no exsanguination with the expressing bandage was performed prior to the interruption of blood flow. Samples of blood for the various analyses were obtained through a Landeman needle inserted in a distal direction into a radial vein at the wrist. In order to prevent venous blood flowing back from above, a second

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tourniquet was inflated just above the needle at a pressure slightly higher than venous pressure (Fig 1).

It is generally agreed that venous blood directly leaving the tissue capillaries is in a state of metabolic and biochemical equilibrium with the tissues themselves. When the blood flow is interrupted, ideal conditions are set up for such an equilibrium meanwhile sampling of blood from the post arteriolar capillary bed becomes easier to achieve owing to the intense vasodilation opening the whole vascular network below the point of application of the tourniquet.

As further studies were difficult to carry out on humans for fear of unexpected accidents, experimental work was undertaken on a group of 7 Macaca mulata. These animals were chosen because the anatomy of the limb in them is similar to that of humans in that both have basically the same ratio of bone to lean tissue. The monkeys were anaesthetized with intravenous pentobarbital; a tracheostomy was performed and intermittent positive pressure breathing was applied through it. The sciatic and posterior tibial nerves were freed from their bed by careful dissection the first close to the sciatic notch the latter at the ankle. Great care was paid neither to devascularize the nerve nor to expose too long a section of it to atmospheric air. Excitability and conduction were investigated through continuous monitoring of the dynamic quality of evoked potentials travelling along the nerve between a stimulating and a recording electrode. The evoked responses were amplified by means of a condenser coupled differential amplifier recorded on a cathode ray oscilloscope and photographed.