SIXTH - IV

SPECIAL PROCEDURE OF PREPARATION

The general behaviour and stability of the isolated perfused rat heart was assessed by visually monitoring:

(a) Cardiac rate and rhythm
(b) Force of contraction
(c) Coronary flow rate
(d) Perfusion pressure

The cardiac rate throughout the studies on the control group was 200 - 250 beats/minute. This rate was usually reached within 5 minutes in the pre-perfusion procedure, and hearts which did not respond adequately were discarded under the following conditions:

(i) when the rate remained persistently low, though the rhythm was regular viz., heart rate lower than 150/minute.

(ii) when the rhythm was irregular.

After the transfer of the hearts into the closed re-circulation assembly, there was usually a slight fall in heart rate to about 150/minute, which recovered within 2 minutes of the commencement of closed perfusion (Fig. 25). Thereafter the heart rate progressively
Course of heart rate — through the experiment — completely arrested heart at dissection — chilling — mounting — recovery within 2 minutes steady heart rate thereafter — except a slight fall while transferring into exclusion assembly for closed re-circulating perfusion.
detected or transfer into the closed assembly, it was
discarded.

The appearance of a marked asystole at any stage in the
mounting or during perfusion, was an indication to discard
the preparation. On some occasions the asystole was in the
nature of extrasystoles early in the pre-perfusion period
which rapidly reverted to normal rhythm, when such preparations
were utilized for study.

The force of contraction was visibly recorded, and a steady
force of contraction was usually observed within 30 seconds
of commencement of pre-perfusion which was maintained till the
end of the perfusion period. The force of contraction was
related to the perfusion pressure, and could be altered to a
slight degree by raising or lowering the perfusion pressure by
the adjustment of the pressure source on the pump. The degree
of variability was ± 50 mm.Hg. from the normal required
(90±20 mm.Hg). The range of alteration employed was however
only ± 5 mm.Hg. Full of pressures greater than 90 mm.Hg
resulted in bradycardia, deteriorating into fibrillation, while
a rise a pressure greater than 50 mm.Hg. resulted in a marked
fall in force of contraction, which terminated in asystole
with a greatly distended heart. This was observed whenever
attempts were made to increase the force of contraction in
poorly perfusing hearts, and which were eventually discarded.
Coronary flow rates, in both pre-perfusion and closed perfusion systems were constant and this was measured in a small group of hearts initially, the optimal flow rate being 3.0 ± 1.5 ml/minute. Coronary flow rate was closely dependent on the perfusion pressure, and any increase in perfusion pressure resulted in an increased coronary flow rate. (Fig. XV).

Opie (1965) observed that to achieve a stable preparation for metabolic studies, the coronary flow rate needs to be maintained constant throughout the perfusion period even if this involves adjustment of perfusion pressure. This was therefore resorted to, in control studies, and adjustments were made in the initial 5 - 10 minutes and this period was excluded in the study from perfusion time. More time was recorded for commencement of perfusion only after this initial period of "stabilisation". (Fig. I A).

In a total of 26 hearts studied in the control group, 27 stabilised immediately after pre-perfusion, 18 hearts within 5 minutes and 3 hearts within 20 minutes of transfer into the closed circuit assembly. The percentage analyses for stabilisation periods are as indicated elsewhere.
# Table of Isolated Perfused Rat Heart

<table>
<thead>
<tr>
<th>Isolated</th>
<th>No. of Hearts</th>
<th>% of Hearts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediately after pre-perfusion and transfer into the closed recirculating assembly</td>
<td>27</td>
<td>53.22</td>
</tr>
<tr>
<td>Within 5 minutes after commencement of closed recirculating perfusion</td>
<td>22</td>
<td>7.69</td>
</tr>
<tr>
<td>Within 20 minutes after commencement of closed recirculating perfusion</td>
<td>3</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Total No. of hearts = 52
Linear relationship between heart rate and coronary flow rate within limits—though flow rate increases with heart rate, ideal for survival for the perfusion period conducted in this study was a flow rate of 6.0 ± 1.4 ml at a heart rate of 200 ± 30 / minute.
Linear relationship between coronary flow rate and perfusion pressure. At low pressures, coronary flow rates increase with increasing perfusion pressure, and at high pressures, coronary flow rates decrease. The perfusion pressure used in this study was 55 ± 5 mm Hg, resulting in a coronary flow rate of 8.0 ± 1.5 ml/minute.