the largest maternity hospital in Britain or Ireland, the benefits are still being assessed. These extend beyond mother and child – to doctor, nurse, and administrator.

Acknowledgments: I am grateful to Professor I MacGillivray, Professor J H McK Pinkerton, Professor A C Turnbull, Professor C J Dewhurst and Professor J A Stallworthy for information on which the comparative figures are based.

REFERENCES
O'Driscoll K, Jackson R J A & Gallagher J T
(1969) *British Medical Journal* ii, 477
(1970) *Journal of Obstetrics and Gynæcology of the British Commonwealth* 77, 385

Professor J S Scott
(*Department of Obstetrics and Gynæcology, University of Leeds, 17 Springfield Mount, Leeds, LS2 9NG*)

Drug Therapy in Labour and Reduction of Induction-delivery Interval

New methods of efficiently administering oxytocin, particularly to reduce the induction-delivery interval, have highlighted some major principles of drug administration. (1) Drug usage differs according to whether the circumstances are 'acute' or 'chronic'. 'Acute' situations include anæsthesia, intensive-care episodes and labour. 'Chronic' covers most general practice and medical therapy. Often in chronic situations effective drug levels are never achieved and any influence is of a placebo nature. (2) Drug response depends on a whole series of variables such as the patient's weight, severity of symptoms or disease, route of administration, and metabolism. (3) It follows that often in acute situations there is no such thing as a 'routine' dose. (4) In an acute situation subthreshold dosage is a potentially dangerous waste of time, while excessive dosage is also dangerous with potent drugs. (5) In acute situations it is of greatest importance to establish the minimal effective dose in the shortest possible time and to maintain it for as long as necessary. (6) To achieve this, inhalational and intravenous routes are the most appropriate – oral and intramuscular administration have little place in acute pharmacology. Using these routes with drugs which produce rapid effects, a logarithmic rather than an arithmetic progression is often appropriate to establish the minimal effective dose. (7) Efficacy should be assessed by specific recording of the relevant parameters.

Labour as an 'Acute' Situation

Recently there has been a widespread reappraisal of our approach to labour and it has come to be accepted for purposes of care as a high-risk episode, qualifying for intensive management principles. It is now appreciated that to allow such an acute situation to be unnecessarily prolonged is bad for baby and mother. Also, the longer patients are in the intensive labour-care areas the less care any individual one will get and the fewer can be accommodated. For crystallizing this active management approach we must thank Professor O'Driscoll and colleagues (1969, 1970) for what must be regarded as a significant milestone in clinical obstetrics.

It is, however, important to remember, as the perinatal mortality survey data emphasize (Butler & Bonham 1963), and as is borne out by studies on precipitate labour, that the extremely short labour is also hazardous. This serves to remind us that by its warning nature labour pain has a vital protective function. The completely painless labour is a potential disaster, with the baby liable to be born in the street or the lavatory. This function of pain needs restating. Some of us have been almost brain-washed by the propaganda of the disciples of the natural childbirth cults to the effect that pain in labour is unnecessary. This is not so – it only becomes so once labour has been diagnosed and intensive care initiated.

Drug usage in labour has not been up-dated with this new intensive-care approach. With the notable exception of the practice introduced by Professor Turnbull and his colleagues in relation to oxytocin (Francis *et al.* 1970), much drug administration in labour is inefficient.

Applications of Pharmacological Principles

Oxytocin in induction of labour: We have used the automatic log-increment pump (ALIP), as developed by Turnbull, for over a year. The data refer to inductions up to the beginning of August 1971, in 66 primigravidæ and 63 multigravidæ. Infusion was begun within one hour of amniotomy. Some cases were electronically monitored with a cardiotocograph, but the majority were not. We used as controls the 66 primigravidæ and 63 multigravidæ in whom labour was induced immediately before the pump became available, indications for induction being similar.

The amniotomy-delivery interval was almost halved, to a matter of 8 hours. As most amniotomies were done in the morning, this meant that

a high proportion of patients were delivered before night – almost 90% were delivered within 12 hours, as against less than 50% in the control group. The apparatus was highly acceptable: patients appreciated being relieved of the slow drip torture, and staff of the tedium of having to control it.

No perinatal deaths occurred. There was no significant difference in the incidence of operative deliveries in the two groups, and the indications were similar. Among the ALIP cases there were 7 inductions for fœtal bradycardia, compared with 3 in the control series, but the distribution of Apgar scores was virtually identical in the two series. Although the total amount of pethidine used by patients on the pump was less than by the controls, there was no significant difference in the quantity per kg per hour of labour – the only logical way to compare pethidine quantities.

Theoretically it may be possible to operate the same incremental system by nonautomatic means, but the ruthless logarithmic logic of the pump is in practice hard to match with manual control of a gravity-feed oxytocin infusion. I find the 'physiological' oxytocin infusion concept difficult to comprehend; I believe that oxytocin should be given on a proper pharmacological basis, to achieve the minimal effective dose as rapidly as possible, and that logarithmic increase from a low initial dose is the best for labour induction; the automatic log-increment pump is ideal for this purpose.

Pethidine for pain relief in the first stage: The dose threshold response for drug therapy in labour has also been utilized in relation to analgesia. Simpson first introduced it with chloroform, and Minnitt (1934) combined with it another major principle, that of allowing the patient to be the arbiter of dose adequacy. Pain is entirely a subjective phenomenon, and it is therefore appropriate to rely on the subject's assessment.

Minnitt's apparatus and its descendants, such as Entonox, have their main application in the second stage of labour. In our unit we have used exactly the same principles with pethidine given intravenously in the first stage (Scott 1970). The pain of labour is crescendo, whereas post-operative pain is diminuendo; in the latter, a failure to achieve adequate analgesia by the intramuscular route is not disastrous, but in the escalating situation of labour pain it means that the patient will suffer distress and serious loss of confidence. The patient-controlled technique permits her to get as much pethidine as she needs. The spring clamp feeds pethidine into the system only when the patient is actively pressing it, as with Minnitt's machine. If she has had enough or falls asleep, administration ceases. Gordon & Pinker (1958), who reported a series of 500 cases using pethidine from 400 mg to a maximum of over 1600 mg, took us a long way towards this philosophy. They used nalorphine prior to delivery to counteract respiratory depression; we keep it in reserve to give to the baby if it is necessary, which it virtually never is.

This 'demand feeding' of pethidine does not result in any significant increase in the amount patients receive. The drug is, however, used far more efficiently, keeping the so-called 'threshold of acceptability' of discomfort continuously close to the pain intensity level. Self-controlled pethidine administration is entirely compatible with the intensive care approach to labour; conversely, it is not suitable for such anachronistic situations as domiciliary confinement. If we do not adopt a technique of this sort, then I believe we should stop using such drugs and go over totally to conduction-block analgesia.

Hypotensive therapy in labour: Another situation requiring acute drug therapy in labour is the hypertensive crisis. Prompt establishment of the minimal effective dose is then vital. In our unit we use Puroverine, largely for reasons of familiarity. The principles of administration are exactly the same as for oxytocin, and we have employed the automatic log-increment pump. With a concentration of Puroverine 0.8 mg/500 ml we have been able to establish control of severe hypertension in about an hour, compared with an average of 3–4 hours previously.

Conclusion

Although there have been many important advances in regard to care during labour, drug usage techniques have lagged behind. The automatic log-increment pump embodies a fundamental principle of efficient drug therapy in the acute situation.

REFERENCES

Butler N R & Bonham D G
(1963) Perinatal Mortality. First Report of the 1958 British Perinatal Mortality Survey. Edinburgh & London
Francis J G, Turnbull A C & Thomas F F
(1970) *Journal of Obstetrics and Gynæcology of the British Commonwealth* 77, 594
Gordon D W S & Pinker G D
(1958) *Journal of Obstetrics and Gynæcology of the British Empire* 65, 606
Minnitt R J
(1934) *Liverpool Medico-Chirurgical Journal* 42, 69
O'Driscoll K, Jackson R J A & Gallagher J T
(1969) *British Medical Journal* ii, 477
(1970) *Journal of Obstetrics and Gynæcology of the British Commonwealth* 77, 385
Scott J S
(1970) *American Journal of Obstetrics and Gynecology* 106, 959