interesting review of present and future developments in imaging, but in some respects exaggerates the advantages of some of the recent developments.

The new fluorescent screens using rare-earth elements have certainly enabled one to reduce the radiation dosage to the patient in some cases, but I do not agree that "there is virtually no loss of detail with these faster screens." We have certainly done no research here, but two manufacturers have produced the best that they can offer, with dose reduction to about one-eighth of that with standard speed, screens, and film, or about one-quarter of that used when one is using fast tungstate screens and fast film. Unfortunately, in both cases the loss of definition on the final film was gross and the results were quite unacceptable except when one was using the screens for a procedure in which fine definition was not required, such as for operative cholangiography. And even this fourfold advantage in radiation dosage was obtainable only at a quite enormous cost. Furthermore, the life of these screens is unknown and there is a suspicion that one will be putting out initial outlay many times that of conventional screens perhaps four times as often.

In other respects the review was most encouraging, but in the present economic difficulties of the country and of the Health Service it seems unwise, to say the least, for a leading article of this nature to encourage people to undertake considerable additional expenditure which may prove to be wasted.

The review of electronic imaging promises great things if the money is available. Having recently seen, at close range, the installation of modern new equipment, I and some others have been appalled at the complexity and the cost in man hours, materials, and money, to say nothing of the energy used in preparing these materials. This reflects the increasing sophistication of much modern office and business machinery at a time when the energy resources of the world should be dictating to us that we must simplify our lives. It is a pity that none of us have the courage to say "thus far and no farther" and to demand the installation of simple, reliable, and not very costly x-ray machinery. We know that a department and hospital so equipped would become known as a backward museum where such recent developments as cardiac surgery, organ transplantation, and E.M.I. scanning cannot be carried out. But will these highly refined medical procedures ever reach the mass of the world's population? Is it right that we should spend such vast sums for the benefit of those few countries and those very few people in the world who can benefit from them, despite the vast cost of these to the rest of the population who cannot be covered by their use?—I am, etc.,

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Comparison between Laparoscopic Sterilization and Tubal Ligation

SIR,—We read with interest the observations of Dr. G. Hughes and Mr. W. A. Liston (13 September, p. 637) and were impressed by the similarity between their results and those of this unit. However, there were points of

difference that have led us to different conclusions.

In this unit, where all laparoscopic procedures in the area are performed, 3532 sterilization procedures were carried out between 1969 and 1973, 643 by laparoscopy and 2889 by laparotomy. Our laparoscopic technique did not differ from that of Dr. Hughes and Mr. Liston. The failure rate of laparoscopic sterilization was 2.5% and that of tubal ligation 0.06%. Complications in the former group were principally operative and occurred in 6.5% of cases, being serious in three cases, of which two involved damage of large vessels and one of bowel. The principal complication was that of mesosalpingeal bleeding in 3.3% with laparoscopy failing in 2.8% (19 April, p. 137). These results and those of the Aberdeen series justify the cautious attitude of Mr. E. E. Rawlings and Mr. B. Balgobin (29 March, p. 727) towards laparoscopy, being inferior to those of earlier reports,¹ when laparoscopy was probably performed only by more experienced operators.

Alteration of the usual technique of tubal ligation in this unit has given good results. Madlener and Pomeroy procedures are performed on each Fallopian tube and care is taken to use as small an incision as possible. A Cusco speculum has been used as a retractor in many cases to facilitate this, as suggested by Greenhall.² This modification has allowed discharge from hospital after 48 hours in 82% of cases without ill effects, and a minimal failure rate has been achieved with no operative complications. Postoperative morbidity was similar in each group, chest infection occurring in 2.2% of laparoscopies and 3.4% of laparotomies, urinary infection in 0.6% and 1.2%, and wound dehiscence in 1.8% and 3.8% respectively. Thromboembolic disease and anaesthetic complications were not encountered.

All grades of staff are trained in both procedures in this unit. With similar minor complication rates in both groups in this series we feel that the higher failure rate of laparoscopic sterilization, with the occurrence of a small number of serious complications, must expose the procedure to criticism under these circumstances. The solution would seem to be to restrict the use of the procedure to operators with very wide experience in the technique, an unacceptable limitation in a teaching gynaecological unit. Early discharge from hospital, often cited as the great advantage of laparoscopy, can also be achieved in a high proportion of patients undergoing tubal ligation.—We are, etc.,

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¹ Shepherd, M. K., *Obstetrical and Gynaecological Survey*, 1974, 29, 739.

² Greenhall, J. O., and Roberts, H. R., *British Medical Journal*, 1971, 3, 304.

Laparoscopy Explosion Hazards with Nitrous Oxide

SIR,—Nitrous oxide is more frequently being used as the inflating gas during laparoscopy because the previously used alternative, carbon dioxide, may have undesirable side

effects following absorption.^{1,2} However, the explosive risks with such a nitrous oxide technique appear to have been overlooked.

The fact that nitrous oxide will support combustion in mixtures with hydrogen and methane and that such mixtures will ignite explosively over a very wide range of compositions is well documented.³ Hydrogen is one of the two predominant components of intestinal gas, being present in proportions up to 47% by volume.⁴ Up to one litre of gas may be produced daily and, in a sample population examined by Levitt *et al.*,⁴ one-third of the population had methane in their intestinal gas in proportions up to 26% by volume. Hydrogen is one of the most diffusible gases known, so inevitably the abdominal cavity itself must contain large concentrations of hydrogen and, probably in many cases, methane. The proportion of hydrogen in mixtures with nitrous oxide at the lower explosion limit at atmospheric pressure is only 5.5% by volume. Furthermore, the reaction is sensitized by the presence of traces of water vapour, oxygen, or traces of organic vapours.³ Gas mixtures of these concentrations must be present in the abdominal cavity during laparoscopy with nitrous oxide.

The activation energy required to initiate a hydrogen/nitrous oxide explosion is the same as that required to initiate a hydrogen/oxygen explosion—about 100 kJ/mol of hydrogen.⁵ As an explosion arising from diathermy electrodes will be initiated in a minute volume, the energy required will be only of the order of 0.1 J. The power output at working diathermy electrodes is considerably more than that required to raise the temperature of the gas mixture immediately around the electrode above that required to initiate an explosion. Similarly, the activation energy of methane/nitrous oxide mixtures is 260 kJ/mol,⁵ and explosive conditions can easily be reached in the abdomen. Mixtures of hydrogen, methane, and nitrous oxide can be expected to ignite explosively in the same way as hydrogen/nitrous oxide mixtures; once the explosion in the more complex mixture has been initiated, methane will assist in its propagation.

Though nitrous oxide has been recommended by Corall *et al.*,² among others, as the laparoscopy inflating gas in order to reduce the cardiac arrhythmic hazards associated with insufflation of the abdomen with carbon dioxide, we would suggest that these hazards are minimal compared with what must be the fatal danger of an explosion in the abdomen during laparoscopic sterilization by diathermy.

The main factor governing the choice of insufflation gas is high water solubility at blood temperature, a property of both nitrous oxide and carbon dioxide. The inert gases argon, krypton, and xenon are all less soluble than nitrous oxide, but of these xenon is the closest, having about 25% of the aqueous solubility of nitrous oxide at blood temperature.^{6,7} Xenon was a high lipid/water partition coefficient and this would obviously assist in its absorption.⁷ The principal disadvantage of the use of xenon is its considerably greater cost than that of nitrous oxide or carbon dioxide.

It would seem that carbon dioxide is preferable as the inflating gas because its pharmacological effects are more easily

countered than the finality of an explosion supported by nitrous oxide.—We are, etc.,

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- 1 Scott, D. B., and Julian, D. G., *British Medical Journal*, 1972, 1, 411.
- 2 Corall, I. M., et al., *British Journal of Anaesthesia*, 1974, 46, 925.
- 3 Beattie, I. R., in *Mellor's Comprehensive Treatise on Inorganic and Theoretical Chemistry*, vol. 8, suppl. 2, pp. 209-215. London, Longmans, 1967.
- 4 Levitt, M. D., Michael, D., and Bond, J. M. jun., *Gastroenterology*, 1970, 59, 921.
- 5 Drummond, L. J., *Bulletin of the Chemical Society of Japan*, 1969, 42, 285.
- 6 Kety, S. S., *Pharmacological Reviews*, 1951, 3, 5.
- 7 Rinfret, A. P., and Doebbler, G. F., in *Argon, Helium and the Rare Gases*, ed. G. A. Cook, chap. 19. New York Interscience, 1961.

G.P. Obstetrics in the Future

SIR,—We were interested in the comments of Dr. M. J. V. Bull (5 July, p. 39) concerning the role of the general practitioner obstetrician in the future. We would not wish to quibble with Dr. G. Lloyd's statistics (11 January, p. 79) nor with those of Dr. Bull. The experiences of Drs. K. L. Oldershaw and J. M. Brudenell (18 January, p. 139) are very much in line with our own. Arising out of discussions which were held in Wessex between the Regional Faculty of the Royal College of General Practitioners' maternity subcommittee and the department of human reproduction and obstetrics of Southampton University, it was our view that with the reorganization of the Health Service it was an appropriate time to re-appraise the role of the G.P. in the practice of obstetrics in various parts of the United Kingdom.¹

We have proposed that there should be a two-tier system of G.P. involvement in obstetrics:

(1) *Office obstetrics*—that is, antenatal and postnatal care of patients booked for integrated care. G.P.s on the existing obstetric lists do quite adequately carry out these functions. On the other hand we consider that the existing obstetric list and its criteria as defined at present are generally inadequate and unsatisfactory for the involvement necessary in modern intranatal care. While these criteria urgently need revision for modern labour ward obstetrics, they are probably adequate for "office obstetrics" as defined here.

(2) *Total obstetric care*, which would include intranatal care and baby resuscitation in a district hospital and/or G.P. unit. This would require a degree of training and far greater involvement in obstetrics than G.P.s at present enjoy. These G.P.s would therefore need to have specialized in obstetrics to a significant degree in order to participate in intrapartum care and yet continue their major interest in general practice. This would certainly entail a significant part-time commitment for those G.P.s who may have spent a considerable amount of their training in obstetrics and some of whom may even hold a higher qualification. It would be essential for G.P.s who are involved in intranatal care to have had such specialist training or to be prepared to undergo the appropriate training.

We therefore propose that the hospital obstetric team should consist of a consultant, a registrar, and a new type of G.P. who would have a special interest in obstetrics, as well as house officers. This "hospital practitioner in obstetrics" would spend a number of days or half days actually in the

maternity unit, being on duty for a large number of patients under G.P. care to the exclusion of his other practice responsibilities. In a large urban area this would imply that those group general practices providing complete obstetric care would each have one hospital practitioner in obstetrics who would supply the necessary cover for G.P.s' booked patients and would operate a rota system with colleagues from other practices. In addition, where the geography of the area merited this, there would need to be peripheral maternity units run by such hospital practitioners. For these hospital practitioners in obstetrics working in peripheral units, as well as their colleagues who are members of the obstetric team, a close attachment to an obstetric department is essential. They would need to maintain their clinical standards and take part in the continuing postgraduate education and activities of the consultant team, which would include attendance at perinatal mortality and morbidity meetings with its implication of uniform record-keeping and audit in that district.

We would hope that posts in general practice with a third- to half-time commitment as a hospital practitioner in obstetrics to a maternity unit might be established in order to meet this need and utilize the skills of doctors who have spent years in hospital obstetrics and yet wish to practise primarily as family doctors.—We are, etc.,

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¹ Elstein, M., et al., *Journal of the Royal College of General Practitioners*, 1975, 25, 373.

Effect of New β -Adrenergic Blocking Agent

SIR,—Dr. P. Roy and others (26 July, p. 195) not only state that they were comparing I.C.I.66082 with practolol and placebo but also that "I.C.I.66082 was found to be superior to practolol and placebo in all values assessed." It must be clear to anyone reading their article that they failed to do so.

The authors give only the mean values obtained in their trial without any indication of the variances, and it is therefore impossible for readers to make any inference

on the basis of the published data. The only statistical information which the authors provide are the results of statistical tests comparing I.C.I.66082 with placebo; though it is not entirely clear what they were comparing I.C.I.66082 with when they found that patients taking I.C.I.66082 "had significantly fewer attacks of angina ($P < 0.03$)."

This shows that I.C.I.66082 is superior to placebo but provides no information about I.C.I.66082 as compared with practolol. I am prepared to accept that I.C.I.66082 is better than practolol but I would need some statistical evidence before I do so.

The second point which I would like to make concerns levels of significance. When examining the total exercise we are told in one sentence that $P < 0.06$ represents significant difference, while in the following sentence $P > 0.03$ does not. This is perhaps logically possible ($P = 0.001$ and $P = 0.2$ respectively) but it would be a rather unusual way of putting it.—I am, etc.,

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** We showed Dr. Hanka's letter to Dr. Roy's colleagues (Dr. Roy being now abroad), whose reply is printed below.—ED., *B.M.J.*

SIR,—Dr. Hanka is quite correct in pointing out that the statistical justification for the different comparisons of drugs was not included in our paper and we are now pleased to provide it. There was little evidence of differences between doses affecting any of the measured variables for either practolol or I.C.I. 66082. Hence overall treatment means, ignoring dose, were compared by Student's *t* test using the appropriate residual mean squares from the analysis of variance to estimate the standard errors. The significance levels for each comparison pair of drugs are shown in the table.

The significance levels quoted in our summary were based on F tests from the analysis of variance and are pertinent to the question whether any of the treatment means differ from one another. The direct comparison of the overall I.C.I. 66082 mean with the placebo mean gives higher levels of significance—namely, $P < 0.001$ —for both frequency of anginal attacks and amount of trinitrin consumed.

Dr. Hanka is also right to question the significance level " $P > 0.03$." This should have read " $P > 0.3$ " and we apologize for this mistake.—We are, etc.,

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		P Values		
		Placebo-Practolol	Placebo-I.C.I. 66082	Practolol-I.C.I. 66082
Systolic blood pressure	before exercise	<0.02	<0.001	N.S.
	after "	<0.01	<0.001	>0.01
Pulse	before "	N.S.	<0.001	>0.001
	after "	<0.001	<0.001	>0.001
Diastolic blood pressure	before "	N.S.	<0.001	>0.01
	after "	N.S.	<0.02	N.S.
Exercise tolerance (k.p.m.)		N.S.	<0.05	N.S.
Attacks of angina		<0.001	<0.001	>0.001
Trinitrin consumption		N.S.	<0.001	>0.001

N.S. = not significant.