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# Quinacrine pellet method of non-surgical female sterilization

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## INTRODUCTION

Voluntary female sterilization is the most prevalent contraceptive method today, used by over 138 million married women of reproductive age compared to 95 million in 1984<sup>1</sup>. In the United States more than two-thirds of couples who want no more children have been sterilized; in the majority, the wife has undergone the procedure<sup>2</sup>. In the developing world, about 23% of married women of reproductive age have been sterilized. In countries such as Brazil, China, Dominican Republic, El Salvador, India, Republic of Korea, Panama, Sri Lanka and Thailand, the prevalence of sterilization among these women is over 30 %<sup>3</sup>. Increases in the number of procedures have been largely due to the improvement of surgical techniques, with concomitant effective training programs over the past two decades<sup>4</sup>.

In the light of this extraordinary progress, why promote a non-surgical method? We contrasted the quinacrine pellet and surgical methods in terms of their relative safety, efficacy, cost and potential contribution to reducing maternal morbidity and mortality and rapid population growth.

## FUTURE STERILIZATION NEEDS

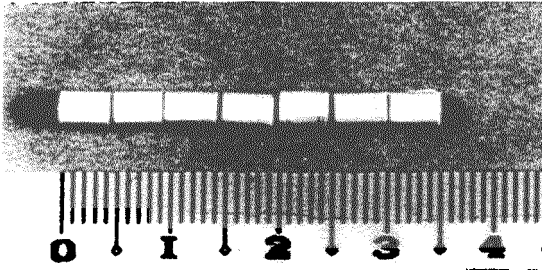
Based on current trends in the growth of sterilization acceptance in developing countries, predominantly by women, Ross estimated there would be 159 000 000 new sterilizations in the 1990s, thereby raising the prevalence from 23.5 to 28.8% of couples'. The modesty of this increase is due to the fact that nearly half of the gain in users is being

offset by the increase in the numbers of married women of reproductive age in developing countries. If the 47% sterilization prevalence in such women as is now seen in Korea and Puerto Rico, is to be achieved by the end of the decade, Ross' estimate will be exceeded by 169429000 sterilizations'. It is unlikely that surgical sterilization could meet this need safely in this decade because of the limitations of surgical resources.

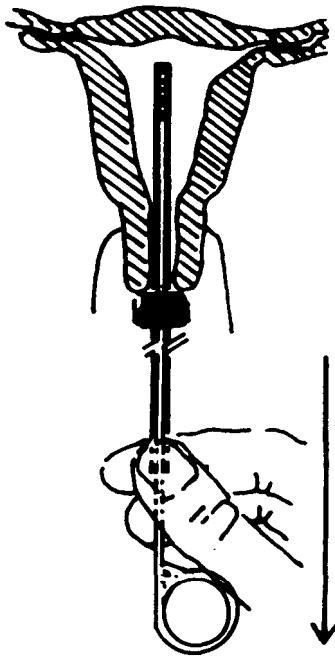
One might question whether the demand exists in non-industrialized nations to raise sterilization prevalence to 47%. Ravenholt notes that it is not possible to establish the level of demand for a family planning method until the method is fully available to all who may desire it<sup>6</sup>. Numerous estimates based on demographic and health survey data indicate that many women not currently using contraception in those countries plan to use sterilization in the future'. In Namha Province, Vietnam, where surgical sterilization was available at all district hospitals and the quinacrine pellet method was offered at a small proportion of commune health centers, the ratio of acceptance in 1992 was 11: 1 in favor of the non-surgical method. It is not unreasonable to project a sterilization prevalence of 47% in the developing world if the quinacrine pellet method of non-surgical sterilization were made truly available.

## QUINACRINE PELLETS STERILIZATION

This method, developed by Zipper', involves transcervical application of pellets of quinacrine in the proliferative phase of the menstrual cycle using a modified Copper T



**Figure 1** Quinacrine pellets (252 mg) for one insertion; length in centimeters



**Figure 2** Quinacrine pellet insertion technique using an intrauterine device inserter

intrauterine device (IUD) inserter. The pellets are cylindrical in shape to accommodate the inner diameter of the inserter (Figure 1). The application technique generally used is similar to that of an IUD insertion (Figure 2), leaving the quinacrine pellets deposited at the uterine fundus. Most experience is with seven pellets of 36 mg quinacrine with rapid dissolution time. The procedure is performed once or twice at a monthly interval. Recently, Zipper has added 50 mg of diclofenac as pellets to the quinacrine insertions to both reduce mild side effects and improve efficacy.

The quinacrine pellet method requires technical skills similar to those for IUD insertion. A large and increasing number of nurses are capable of carrying this out, especially in developing countries. The potential access to the quinacrine pellet method is, therefore, very large.

### SAFETY

There is wide variation in the safety of surgical female sterilization between industrialized and developing countries. Case-fatality rates in the United States are reported as 1-4/100 000 procedures<sup>10</sup>, whereas in less developed nations they range up to 19<sup>11</sup> or 21<sup>12</sup> but are thought generally to be 6-8/100 000 procedures. In over 30 000 cases of quinacrine pellet sterilization in Vietnam<sup>13</sup>, 10 000 cases in India<sup>14</sup> and 5000 cases in other regions of similar economic status<sup>15</sup>, no death has been reported.

Other aspects of mortality that are not counted in procedure case-fatality must, however, be considered. These include maternal death during pregnancy arising from failure of the methods, and particularly those due to ectopic pregnancy. In comparing sterilization mortality for the United States and Bangladesh, as an illustration, the following assumptions are made. In either country, surgical sterilization will have a failure rate<sup>16</sup> of 0.5%, and there will be an ectopic pregnancy rate<sup>17</sup> of 7.7% among these failures. In either country, the quinacrine pellet method will have a failure rate of 5% and an ectopic pregnancy rate<sup>18</sup> of 0.8%. However, the delivery/abortion mortality/100 000 live births is 7.9 for the United States" and 570 for Bangladesh", and the ectopic pregnancy case-fatality rate is 0.08% in the United States" and 5% in Bangladesh". The mortality associated with the surgical sterilization procedure is 41/100 000 in the United States" and 19/100 000 in Bangladesh" and nil for the quinacrine pellet method in either country. The estimated deaths attributed to surgical and quinacrine sterilization in these two countries are shown in Table 1, with assumed 5%, 2.5% and 1% failure rates for the non-surgical method and

Table 1 Estimated deaths attributed to surgical female sterilization and non-surgical quinacrine female sterilization in Bangladesh and the United States (per 100000 procedures) by assumed method failure rates

Cause of mortality	Assumed failure rate and method							
	Surgical sterilization 0.5%		Non-surgical sterilization 5%		Non-surgical sterilization 2.5%		Non-surgical sterilization 1%	
	Bangladesh	USA	Bangladesh	USA	Bangladesh	USA	Bangladesh	USA
Procedure	19.0	4.0	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>
Ectopic pregnancy	10.7	0.2	1.7	<0.1	0.9	<0.1	0.3	co.1
Delivery/abortion	2.9	<0.1	28.5	0.4	14.3	0.2	5.7	0.1
Attributable	32.6	4.2	30.2	0.4	15.2	0.2	6.0	0.1

<sup>a</sup>Based on limited published reports

0.5% for the surgical method". There is no difference in attributable mortality for the two methods in Bangladesh at a 5% failure rate for the non-surgical method. Although an advantage is seen for the non-surgical method in the United States, the estimated difference of 3.8 deaths per 100000 procedures is small, considering the uncertainty of our assumptions.

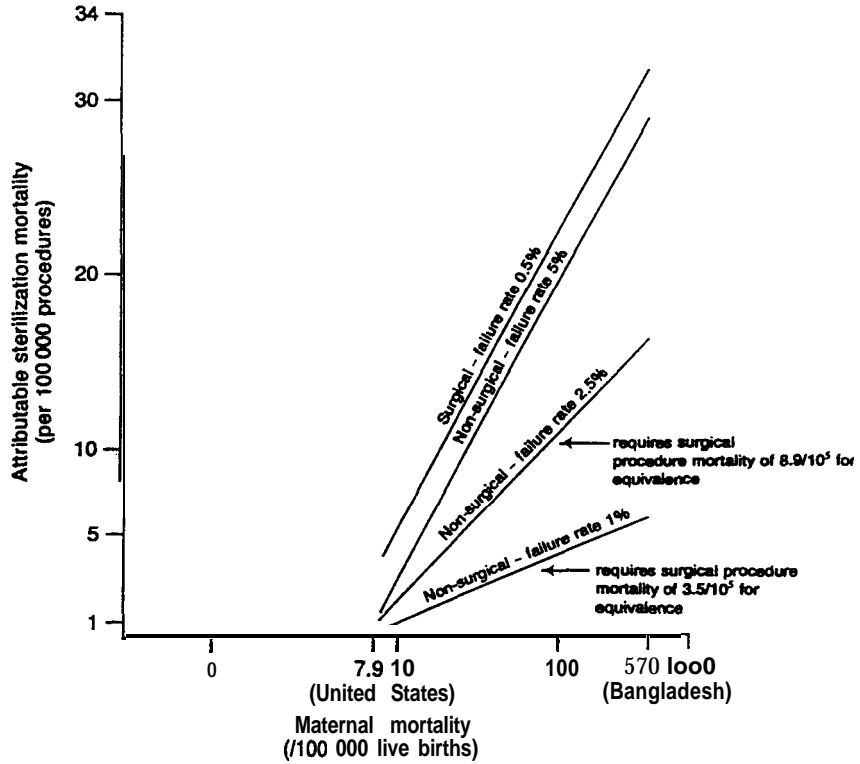
Another realistic scenario follows the newly reported decrease in the failure rate of the quinacrine method by addition of an antiprostaglandin such as diclofenac<sup>9</sup>. If the failure rate is reduced to 2.5% or 1%, it can be seen (Table 1) that in Bangladesh the attributable mortality of the quinacrine method is markedly reduced with lower failure rates<sup>22</sup>. The case can thus be made in favor of the non-surgical method in terms of procedure mortality risk. Figure 3 shows that mortality associated with the surgical procedure would have to be halved, which may be the case today in Bangladesh, to equal the advantage of the non-surgical method with a 2.5% failure rate. If the surgical procedure fatality rate in Bangladesh were the same as it is in the United States and if the quinacrine method failure rate were 1%, only then would neither method have an advantage over the other.

Morbidity is the other important aspect of safety. Reports of the quinacrine pellet method are uniformly reassuring by their absence of serious complications that could be

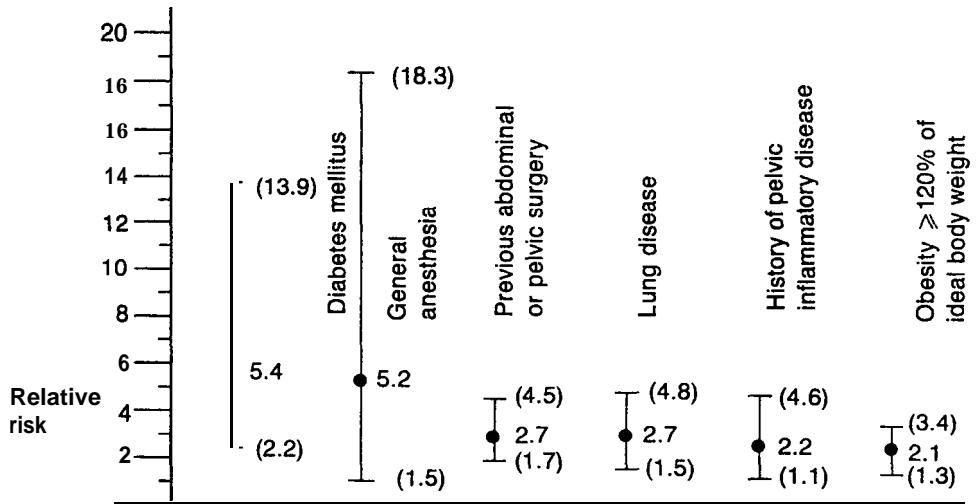
life threatening<sup>8,15</sup>. In a large field trial in Vietnam, Hieu and coworkers<sup>13</sup> found a major complication rate of 0.03%, using criteria of the Centers for Disease Control<sup>23</sup>. The more common side effects are lower abdominal pain, mild fever, headache, oligomenorrhea and amenorrhea. Amenorrhea disappears within 5 months without treatment. Fever and pain can be treated easily with common analgesics.

Both minilaparotomy and laparoscopic sterilization are associated with more serious complications, and their relative risk varies with patient characteristics and associated procedures, such as general anesthesia. In the Collaborative Review of Sterilization by the Centers for Disease Control<sup>23</sup>, of 3500 laparoscopic sterilization procedures in the United States, 37 (1.1%) resulted in unintended major surgery, 16 patients (0.4%) required rehospitalization and seven (0.2%) were treated for febrile morbidity: a total complication rate of 1.7%. The relative risk of developing one or more complications for preoperatively identifiable risk factors is shown in Figure 4.

In a large international study of 24439 laparoscopic sterilization procedures, the International Fertility Research Program (IFRP)<sup>24</sup> found a complication rate of 1.7% for the conditions shown in Table 2. Minilaparotomy does not carry the risk of many of these



**Figure 3** Attributable sterilization mortality\* by surgical and non-surgical quinacrine method and by maternal mortality for various assumed method failure rates



**Figure 4** Relative risk (with 95% confidence interval) of developing one or more complications for various preoperatively identifiable laparoscopic sterilization risk factors<sup>23</sup>. Data from nine US hospitals, 1978-81

\*Assumes surgical sterilization case-fatality of  $19/10^5$  procedures and nil for quinacrine pellet procedures, and straight-line relationship between United States and Bangladesh risks.

**Table 2** Surgical complications/injuries of 24 439 laparoscopic sterilization?

Complication/injury	No.	%
Related to patient characteristic/ approach		
emphysema of abdominal wall	72	0.29
uterine perforation	57	0.23
bowel injury	11	0.05
abdominal/peritoneal injury	10	0.04
artery/vein injury	10	0.04
cervical laceration	7	0.03
incision bleeding	7	0.03
bladder injury	2	0.01
ovarian injury	2	0.01
respiratory problems	1	0.00
Subtotal	179	0.73
Related to tubal occlusion		
tubal/mesosalpinx injury		
with bleeding	139	0.57
without bleeding	67	0.27
occlusive technique to wrong structure	16	0.07
electric shock due to equipment problems	8	0.03
Subtotal	230	0.94
Unspecified	7	0.03
All surgical complications	416	1.70

complications and is generally considered safer than laparoscopic sterilization, especially in the hands of less skilled surgeons<sup>25</sup>. In a large study by the IFRP<sup>16</sup>, the reported complication rate of minilaparotomy was 0.95%. A smaller study<sup>26</sup> by the Collaborative Review of Sterilization reported a total complication rate of 5.7%.

Long-term sequelae of both surgical and non-surgical sterilization have been a concern, but present evidence indicates both procedures are probably free of such problems. Following surgical sterilization, subsequent menstrual changes have been suspected but not proven<sup>16</sup>. In the case of the quinacrine pellet method the possibility of carcinogenesis was considered, but a report of Dabancens and his co-workers in Chile shows no increased risk based on Papanicolau smear changes<sup>27</sup>.

From available data at this time, it appears that the quinacrine pellet method is safer than surgical sterilization in any country.

**EFFICACY**

Efficacy affects safety in terms of the health effects of failures. The efficacy of the quinacrine pellet method, originally considered to have a lifetime failure rate of 5-6%, shows promise of marked improvement. The number of insertions of quinacrine affects its efficacy, as seen in Table 3 for 1 versus 2 insertions<sup>13</sup> and 2 versus 3 insertions<sup>14</sup>. The addition of an antiprostaglandin, 50 mg of diclofenac, to each of two insertions of 180 mg of quinacrine pellets reduced the failure rate from 7% to 2.1% at 1 year<sup>8</sup>. Studies are in progress to evaluate this and other adjuvants in both one and two insertions of 252 mg of quinacrine. The other promising approach, alone or with adjuvants, is provision of a contraceptive of the woman's choice for three cycles from the first insertion.

Merchant and her co-workers<sup>28</sup> noted in pre-hysterectomy studies that short periods between insertion and hysterectomy led to fewer tubal closures on histopathology. El Kady and his colleagues<sup>29</sup> demonstrated 100 % efficacy in 2-year follow-up when women practised contraception until evidence of tubal closure on hysterosalpingogram. Mullick and co-workers have now confirmed these initial leads in a trial among 286 women receiving 2 monthly insertions of quinacrine 216 mg plus ibuprofen 55.5 mg and 3 months' oral contraception from first insertion (Table 4). The failure rate of 1.4 per 100 women at 1 year is an improvement over Mullick's previous experience of 4.1 using 252 mg quinacrine. Larger confirming studies are needed.

Surgical sterilization is highly effective, as evidenced by studies reporting low failure rates (usually <0.5%) at 1- or 2-year follow-up<sup>16</sup>. However, 10-year follow-up by the Collaborative Review of Sterilization shows a 2.8% failure rate for bipolar laparoscopic sterilization and 0.7% for unipolar sterilization<sup>30</sup>.

Efficacy is important. The efficacy of newer protocols of the quinacrine method in terms of long-term follow-up is not yet known, but the difference in efficacy between surgical

**Table 3 Cumulative pregnancy failure rates following intrauterine insertion of 252 mg quinacrine once and at monthly intervals twice and three times**

<i>Period (months)</i>	<i>Cases failed</i>	<i>Cumulative failures No.</i>	<i>%</i>	<i>Standard error</i>	<i>95% Confidence limits</i>
<b>Single insertion (n = 2225; Vietnam)</b>					
6			4.42	0.44	3.54-5.30
12			5.12	0.48	4.16-6.08
18			5.12	0.48	4.16-6.08
<b>Two insertions (n = 9461; Vietnam)</b>					
6			1.54	0.13	1.28-1.80
12			2.63	0.17	2.39-2.87
18			3.50	0.21	3.08-3.92
<b>Two insertions (n = 1342; India)</b>					
6	51	51	3.80	0.52	2.77-4.82
12	3	55	4.10	0.54	3.03-5.16
18	0	55	4.10	0.54	3.03-5.16
<b>Three insertions (n = 553; India)</b>					
6	6	6	1.08	0.43	0.21-1.94
12	2	8	1.45	0.50	0.45-2.44
18	2	10	1.81	0.56	0.69-2.92

and non-surgical methods appears to be narrowing.

**REVERSIBILITY**

In decisions regarding the use of different female sterilization methods, three costs must be considered that relate to their reversibility, assuming equal quality of presurgery counseling: the cost of reversal procedures, the cost (programmatic and social) of failure of reversal procedures, and costs (health and socio-economic) of favoring one method of sterilization over another to save costs in the first and second.

**Table 4 Cumulative life-table pregnancy failure rates following two monthly intrauterine insertions\* of quinacrine 216 mg plus ibuprofen 55.5 mg with three months' oral contraception from first insertion among women in West Bengal, India (n = 286)**

<i>Period (months)</i>	<i>At risk</i>	<i>Cumulative failures</i>		<i>Standard error</i>
		<i>No.</i>	<i>%</i>	
3	286	0	0.0	0
6	265	3	1.1	0.61
9	214	4	1.4	0.71
12	159	0	1.4	0.71

\*Insertions September 1991 to July 1993

To illustrate, let us consider a comparison of standard surgical sterilization procedures (tubal ring applied by laparoscopy or post-partum Pomeroy) versus the quinacrine pellet non-surgical method.

The tubal occlusion occurring following each method – surgical and non-surgical – is quite different both in nature and location. The non-surgical method produces a proximal occlusion that does not extend in depth to the outer muscularis. The surgical approach is at the isthmus and involves all layers of tube. Accepted reversal procedures are different for the two. Proximal occlusions following non-surgical sterilization are treated by reimplantation of the tube, and are reported to have a 50% intrauterine pregnancy success rate. Isthmic occlusions are treated by excision of the scar and reanastomosis of the healthy ends: the reported success rate varies widely, we shall assume an 80% intrauterine pregnancy success rate. It is estimated that 111000 sterilized women in a developing country like Bangladesh and 11100 in an industrialized nation like the United States request reversal.

There is no doubt that introduction of the quinacrine pellet method would increase the prevalence of sterilization in economically

depressed regions. It could be delivered by any health personnel already trained in IUD insertion. The number of places in both the private and public sector with such personnel is much greater than is the case for surgical sterilization. A very conservative estimate of the increase in incidence of sterilization due to availability of this non-surgical method might be 20%.

Using these estimates of success of reversal of sterilization, incidence of reversal requests and effect on incidence of sterilization by addition of a non-surgical method, we can estimate and compare the various costs related to reversal of sterilization as a factor in programmatic choice of methods of sterilization. The difference in reversal procedure costs between the two procedures described is negligible, mainly because so few are performed. Any increase in cost of the implantation procedure compared to reanastomosis would be more than offset by the reduced cost of delivering the non-surgical method.

Using this hypothetical model the following calculations are made for each method, assuming that for each 100 000 sterilizations in a developing country, there are 100 requests for reversal, 80 successful reversals of surgical sterilization and 50 successful reversals of non-surgical sterilization. The cost of the non-surgical choice is therefore 30 additional failures of reversal. This cost must be compared to the impact on maternal mortality of the additional sterilizations performed by the non-surgical method. For each 100 000 additional sterilizations performed, the number of lives of women of reproductive age saved is approximately twice the maternal mortality of the area. On average, each sterilization prevents two deliveries or abortions in rural areas of developing countries. For those areas, this is about 5001100000 live births or 1000 lives saved. If the addition of the non-surgical method provides 20 000 more sterilizations for each 100 000 surgical procedures, then 200 extra lives are saved.

For most industrialized countries with low maternal mortality rates and good access to surgical sterilization and other contraceptive

methods, the number of lives saved by offering non-surgical sterilization would be very few - too few to even estimate, but possibly one. However, in Eastern Europe, with poor access to surgical sterilization and other contraceptive methods, and low to moderate maternal mortality, the number of lives saved by use of the non-surgical method might be 10 % of that of our estimate for a developing country, or 20.

For developing countries, the costs to be compared in the choice of method are the disappointment of 30 women in whom a reversal procedure fails for every 100 000 non-surgical sterilizations against the saving of 200 women's lives per 20 000 additional non-surgical procedures, taking into account the 20 % increase in sterilization occurring with its use. For the United States, we would be comparing the disappointment of 300 women in whom sterilization reversal failed with perhaps one life. For industrial areas of Eastern Europe, the comparison is 300 disappointed women to the lives of about 20. A choice favoring the quinacrine method is very clear for a society with high maternal mortality and poor access to contraception, but because of the uncertainty of our estimates, it is less evident for an industrialized nation.

A newly devised method of removing proximal occlusions by transcervical cannulation of the tube has been successful in treatment of infertility due to this condition<sup>31</sup> and will now be tried for proximal occlusions produced by intrauterine quinacrine for non-surgical sterilization.

## COSTS

The cost of delivering surgical sterilization varies among countries, according to estimates" shown in Table 5. Delivery of the non-surgical quinacrine pellet method would be less expensive everywhere. The personnel, equipment and facilities are similar to those for IUD insertions. The cost of supplies of quinacrine pellets and inserters is < \$1 (US) for the two insertions required per case. Contraceptive needs are rapidly expanding, and the relative costs of surgical and non-surgical sterilizations must be considered<sup>33</sup>.

Table 5 Cost of female sterilization (\$US)<sup>32</sup>

<i>Country</i>	<i>Cost (\$US)</i>	<i>Country</i>	<i>Cost (\$US)</i>
Argentina	1000	Madagascar	31
Australia	924	Malaysia	302
Austria	531	Mexico	433
Bangladesh	27	Myanmar (Burma)	142
Belgium	243	Netherlands	593
Bolivia	208	New Zealand	348
Brazil	571	Nigeria	43
Burundi	16	Norway	938
Cameroon	105	Pakistan	7
Central African Republic	50	Panama	500
Chile	300	Paraguay	99
China	8	Peru	811
Colombia	85	Philippines	9
Costa Rica	814	Sierra Leone	18
Dominican Republic	73	Singapore	3
Ecuador	33	South Africa	100
El Salvador	44	Sri Lanka	9
Ethiopia	48	Sudan	66
Finland	1000	Switzerland	2348
Guatemala	73	Taiwan	208
Honduras	248	Tanzania	18
India	35	Thailand	96
Indonesia	75	Trinidad & Tobago	494
Ireland	697	Turkey	144
Jamaica	254	United Kingdom	482
Japan			
Jordan	674 110	United Uruguay States	1850 130
Kenya	320	Venezuela	455
Korea, South	92	Yemen	42
Lebanon	2609	Zaire	98
Lesotho	11		

**MATERNAL MORTALITY AND MORBIDITY**

By far the most cogent argument for the quinacrine pellet method is that it is easier to deliver in developing countries with high maternal mortality rates. In rural areas of such countries, where it is most difficult to provide safe surgical sterilization services, as a rule two births are prevented for each sterilization. An estimate of maternal mortality prevented for an additional 100 000 quinacrine procedures, due to its ease in service delivery, would be twice the maternal mortality per 100000 live births of the area. This would be approximately twice 500 for most rural areas of the Indian subcontinent, or 1000 maternal deaths averted at an additional cost of quinacrine supplies of <\$100 (US) per life saved. We

know of no more cost-effective way to lower the death rate.

Maternal mortality is, of course, small compared to maternal morbidity, which is unfortunately largely unmeasured. In the United States with over 750000 total sterilizations annually and serious surgical morbidity estimated at 1.7 % , this amounts to 12 750 complications, costing many millions of dollars to treat. The quinacrine pellet method should be an option for women in both industrialized and developing societies - for their health and as a matter of choice.

**SLOWING RAPID POPULATION GROWTH**

In terms of slowing rapid population growth in less developed nations, the quinacrine method can make some contribution where a

significant proportion of births are to older, high parity women who want no more children. This is the case in particular in the rural areas of India where 38% of births are of a fourth child or above<sup>34</sup>. Certainly no single contraceptive method can solve the population problem. Although surgical sterilization services have rapidly expanded, they are not meeting the demand and this deficiency will grow during this decade'. The importance of the population problem is summarized by Sadik<sup>35</sup> in the *State of the World Population 1990*. We are at a critical state where failure to slow population growth now may lead to irreversible environmental damage in the next century<sup>36</sup>.

## DISCUSSION

This analysis indicates that the quinacrine pellet method of non-surgical sterilization should be an option for women today. Access to it would increase contraceptive use among older, high parity women of reproductive age in developing countries. The resulting saving in maternal mortality and morbidity is obvious even though not precisely predictable. There should be a clearly enunciated public policy to conduct trials of the quinacrine method. Thus far, the governments of India, Indonesia and Vietnam have undertaken to do so.

In industrialized nations where health care is already excellent, maternal mortality and morbidity low, and population growth stabilized, the contribution of the quinacrine method is mainly for women at high risk of surgery (see Figure 4) and as an additional option. The savings in morbidity likely to follow such a choice are of considerable importance in terms of women's health and rational use of health resources.

Whereas surgical sterilization has gained wide acceptance as a family planning method over the past 40 years', the quinacrine pellet method remains largely unknown and as yet officially approved only in Namha and Haihung Provinces of Vietnam for service programs. The United States Food and Drug

Administration approved a first **prehysterectomy** study after reviewing phase I studies conducted at Johns Hopkins University<sup>37,38</sup>, but further research needed for marketing approval has never been conducted due to lack of a financial sponsor. Because they disagree with the adequacy of animal studies (E. Wilson, personal communication), the World Health Organization has not recommended clinical trials of the method, despite the record of more than 50000 women who have had quinacrine pellet sterilization with very few serious complications reported". The United States Agency for International Development (AID) has claimed the method is not practical unless it can be reduced to a single insertion (J. Clinton, personal communication).

It appears that official approvals for use of quinacrine for intrauterine application for sterilization will not be forthcoming soon, except in Vietnam, where official clinical trials are well advanced. The question remains, what is the obligation of the physician to his or her patient after reading this paper? Many physicians will see the quinacrine pellet method as a desirable option for sterilization for some women. Some will choose to provide this option under the legal use of an approved drug for an unapproved use, which is permitted in the United States and most countries<sup>39,40</sup>.

Quinacrine is approved in most countries of the world as an antimalarial or for treatment of giardiasis. As an antimalarial it has been extensively studied in higher doses and for more prolonged use than that required for sterilization. The only danger in intrauterine administration would be accidental insertion in an early pregnancy which then went to term. Few such cases are known and they resulted in normal infants<sup>13</sup> (J. Zipper, personal communication). The general principles of teratology as outlined by Wilson and Fraser<sup>41</sup> indicate how difficult it is to draw conclusions about drug effects on the human fetus based on animal data. The toxicology studies in monkeys at Johns Hopkins University<sup>42</sup> suggest that intrauterine quinacrine is embryotoxic but probably not mutagenic. The

risk of teratogenic effects in the quinacrine pellet method at this time seems remote but can only be known from careful follow-up of women and their infants in surveillance of large field trials as are now being conducted in Vietnam. If a teratogenic effect were found in 11100 insertions in pregnant women that could be documented as being of higher incidence than expected in the general population of newborns, and if accidental insertions in pregnancy occurred in 111000 cases, then the risk of teratology in the newborn attributable to the quinacrine method would be 1/100 000 cases. It is unlikely that such a risk could ever be proven, but if it were, it would have to be balanced against the women of reproductive age whose lives could be saved through improved contraception by addition of this method to service programs – the number being approximately 1000 in the least developed areas of the world per 100 000 additional sterilization procedures. It would not be a difficult choice.

Faced with the dilemma that the quinacrine pellet is the method of choice for some women even though quinacrine is not approved by government or international bodies for this use, an increasing number of physicians in some countries have decided to offer it to some of their patients. It is a responsible decision in view of present knowledge of its relative risks and benefits in comparison with surgical sterilization. Women should, of course, be informed of these risks and benefits. In industrialized countries where malpractice litigation is prevalent, it is recommended that written informed consent be signed by the patient. A model consent form is recommended by the International Federation for Family Health (IFFH)<sup>43</sup>. The present recommended protocol of the IFFH is for two insertions a month apart in the proliferative phase of the menstrual cycle of 252 mg quinacrine and 50 mg diclofenac or ibuprofen and three months' contraception of the woman's choice (excluding IUDs) from first insertion. Early studies show a failure rate of < 2% at 1 year with this regimen.

## SUMMARY

Both surgical and non-surgical quinacrine pellet methods of female sterilization are relatively safe and effective methods of permanent fertility control. Surgical methods have the advantage of known high efficacy and can be provided postpartum and post abortion. The main advantage of the quinacrine pellet is its ease of delivery, resulting in higher contraceptive prevalence among high risk women. From present knowledge it also appears somewhat safer than surgical sterilization, especially for women at higher risk of surgical complications. Neither method should be thought of as reversible, although there is some success in the case of the surgical method, especially with clip or ring occlusive devices. There is no experience with reversibility of the quinacrine method. Both methods should be widely available as options to well-informed women who desire no more children.

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