

THE
Journal of Obstetrics & Gynaecology
of India

VOLUME XII, NO. 6

DECEMBER 1962

PUERPERAL TETANUS
A CLINICAL ANALYSIS OF TWENTY-EIGHT CASES

by

L. R. PATEL, M.D., M.R.C.P., S. N. GARDE, M.D., F.R.C.O.G.,
N. K. PARIKH, M.D., and A. R. KAPADIA, M.D., D.G.O.

Introduction

Puerperal tetanus is a rare but serious complication of child-birth. Its exact incidence is difficult to determine, as it is not a notifiable disease (Moynihan, 1956), in the same sense as infectious diseases are. It is probably more prevalent than the literature on the subject would indicate. Puerperal tetanus is sub-divided into postpartum and postabortal varieties. Postabortal cases are commoner and carry a worse prognosis. During pregnancy itself, however, the disease is extremely rare. Tetanus is more common in tropical than in temperate climates. Lack of sanitation, bare-footedness, poverty and illiteracy are important contributory factors. Like eclampsia and rupture of the uterus, post-partum tetanus has become a

chapter of the past in the Western countries, but not so in our country. It is, therefore, surprising that, except for the series of J. C. Patel et al, 1960, no collected studies have been reported from India.

Material and Methods

A total of 403 cases of tetanus were admitted to the Bai Yamunabai L. Nair Charitable Hospital, Bombay, during the years 1959 through 1961; 28 of these were of puerperal origin, amounting to 7 per cent of all cases of tetanus; J. C. Patel et al (1960) report a corresponding figure of 3.3 per cent in a four year study.

All the tetanus patients were admitted on the medical side. The obstetric department collaborated with the physicians in the treatment of these cases from time to time. Each case was graded according to the clinical classification of J. C. Patel and Joag (1959), based on the appearance of various signs and symptoms:—

Departments of Medicine and Obstetrics, B. Y. L. Nair Charitable Hospital, Bombay 8.

Received for publication on 3-8-1962.

1. Lockjaw.
2. Spasms.
3. An incubation period of 7 days or less. The incubation period is defined as the interval between the injury and the onset of lockjaw and/or spasms.
4. A period of onset of 48 hours or less. The period of onset comprises the time between the first symptom (usually lockjaw) and the first convulsion.
5. Fever, i.e. an axillary temperature of 99°F or a rectal temperature of 100°F on admission, or within the next 24 hours.

Cases presenting with all the above 5 criteria were classed as Grade V;

Cases presenting with any 4 out of the criteria were classed as Grade IV;

Cases presenting with any 3 out of the 5 criteria were classed as Grade III;

Cases presenting with any 2 out of the 5 criteria were classed as Grade II;

Cases presenting with any 1 out of the 5 criteria were classed as Grade I.

Grades IV and V cases follow a fulminating course, whereas the patients belonging to Grades I and II are of the mild type, Grade III being intermediate.

The great merit of this classification is that it includes the clinical criteria only, so that it is quite a practicable one. The prognosis is thus easily assessed, at the latest within 24 hours of admission. This is important when one realizes that even today there is no known laboratory aid to gauge the ultimate out-

come. This system of grading, however, is not without its drawbacks. It holds good only if the grade does not change later on and it includes only those criteria which can be judged clinically only. But there are also non-clinical criteria having a bearing on the prognosis, e.g. the nature of injury, site of trauma, the ability to take nourishment, etc. (Knott and Cole quoted by J. C. Patel and Joag, 1959). These non-clinical criteria are deliberately excluded from the grading followed in the present study.

It is not our intention to discuss the routine treatment given to these patients; it has been discussed in a previous communication (Patel and Parikh, 1961). Briefly stated, the drugs used were tetanus antitoxin, gallamine triethyltriodide and chlorpromazine hydrochloride, supplemented by the usual regimen followed for such patients. A few points pertinent to the treatment of puerperal tetanus, however, have been discussed later in the article.

This series of 28 cases has been cut up for clinical analysis. We are aware that this has made the number of cases under each heading too small to be statistically significant.

Analysis and Results

Table I clearly shows that the post-abortal patients face a gloomier prospect as compared to the post-partum victims. The difference is self-evident throughout.

The vast majority of cases belong to the reproductive age group; hence the mortality for patients aged 20-35 years is uniform, viz. 60.7%; signi-

TABLE I
Prognosis of Post-abortal and Post-partum Cases

Case type:	No. of Cases	Recoveries	Deaths	Present series	Mortality percentage J. C. Patel et al. (1960)
All cases	28	11	17	60.7	64.2
Post-abortal group	20	5	15	75	75.5
Post-partum group	8	6	2	25	45.5

TABLE II
Relation Between Age and Mortality

Age group	No. of cases	Recoveries	Deaths	Mortality percentage
20-25 years	15	6	9	66.6
26-30 "	9	3	6	66.6
31-35 "	3	1	2	66.6
36-40 "	1	—	—	—

ificantly, the figures reported for a similar age group in J. C. Patel's series (1960) and in Dave et al's study (1955) are 64.2% and 63% respectively. Even for tetanus in other parts, this age group shows intermediate mortality figures. Between two patients of the same grade, however, the older patient's prospect is more dismal. Neonatal cases are the worst, with deaths amounting to 86.2% (Patel and Joag, 1959); our impression is that in our hospital, the rate is a little lower, i.e., 60% — 70%, this may be because of the fewer number of cases we had. Puer-

peral tetanus stands next only to the neonatal one, in respect of severity.

A look at the Table III strengthens the belief that a short incubation period is an important part of the grading system and carries a grave prognosis. Our figures are lower than those of Patel and Joag (1959) probably because of the smaller number of cases in our study.

Cole (1942) says "that if (a) the incubation period is 7 days or less, and (b) the period of onset is 2 days or less, and if the sum total of (a) and (b) is 9 days or less, the patient is not at all likely to survive".

TABLE III
Relation Between Incubation Period and Mortality

Incubation period days	No. of cases	Recoveries	Deaths	Present series	Mortality percentage Patel & Joag (1960)
0 - 7	21	4	17	80.95	60
8 - 14	6	6	—	—	—
More than 14	1	1	—	—	—

TABLE IV
Relation Between Period of Onset and Mortality

Period of onset	No. of cases	Recoveries	Deaths	Mortality percentage	
				Our study	Patel & Joag (1959)
Less than 1 day	9	—	9	100	80%
1-2 days	11	4	7	63.6	77.6
More than 2 days	8	7	1	12.55	

From Table IV, it is obvious that patients with a very short period of onset eventually end up in the grave. The period of onset is thus an invaluable, in fact, the most infallible, prognostic guide.

TABLE V
Relation Between Period of Onset and Incubation Period and Mortality

Incubation period under 7 days period of onset	No. of cases	Recoveries	Deaths	Mortality percentage
0-24 hrs.	9	—	9	100
25-48 „	8	7	1	12.5
Over 48 hrs.	2	2	—	—
Incubation period				
8-14 days				
Period of onset				
0-25 hrs.	—	—	—	—
25-48 „	6	6	—	—
Over 48 hrs.	3	3	—	—

Table V confirms this observation; the mortality is just staggering. Some authors divide the period of onset into (a) less than 48 hours' group and the (b) more than 48 hours' group. It is our contention that it is better (for estimation of prognosis and response to treatment) to divide the above into (a) less than 24 hours' group and (b) 25-48 hours' group.

Table VI illustrates the well-known observation that in advanced cases (grade IV and V), there is very little

we can do. This classification also gives an accurate prognosis and that it is so almost irrespective of the treatment given. In respect of severity, puerperal tetanus takes a second place only to that of neonatal tetanus. Thus 13 cases out of 28 in this series, i.e. 68% (Patel et al, 1960, record a figure of 56%) belonged to Grade V, all of them succumbing to the diseases. (1) J. C. Patel et al (1960) report that 28 of their 67 cases (41.8%) belonged to Grade

TABLE VI
Relation Between Grades and Mortality

Grade	No. of cases	Recoveries	Deaths	Mortality percentage	
				Present series	J. C. Patel et al's series
I	3	3	—	—	—
II	3	3	—	—	—
III	3	2	1	33.3	11.1
IV	6	3	3	50	70
V	13	—	13	100	92.9

V, with a mortality of 92.9%. This similarity is qualitatively, though not statistically, significant. (2) This serves as a contrast when it is noted that all cases falling in Grade I and II survive.

TABLE VII
Features of Obstetrical Significance

Details	No. of cases
Delivery at home (including one case where the umbilical cord was cut with a rusted knife—both mother and child died)	6
Delivery in hospital	2
Abortion at home (suspected)	18
Abortion in hospital	2
Associated puerperal sepsis:	
1. Postpartum cases (including one with a history of interference)	4
2. Postabortal cases (including 4 with a history of interference in the nature of a stick, chemicals, etc., eleven patients did not give any history of interference—doubtful)	15

We could not culture tetanus bacilli because of technical difficulties; the probable portal of entry was postulated from the history and the clinical evidence.

From Table VIII, it is noted that even with delivery conducted in the patient's home, a less severe case has all the chances of survival, because present-day treatment is competent to salvage such cases. Thus, home delivery by itself is not a contributory factor in the prognosis, but the grading is more important. Of 6 patients who delivered at home, only 1 died (16.6% mortality). Out of 2 hospital delivered cases, one died a 50% mortality. Because of the small number of cases the two figures are not comparable at all. Dr. J. C. Patel's (1960) figures are exactly opposite. 16.6% for hospital cases and 56.25% for home. And these are more representative.

In the present series, 80% of the postabortal cases belonged to grades IV and V, with a mortality of 87.5%. The overall mortality for postabortal cases was 75%. J. C. Patel et al (1960)'s studies reveal that 86.6% of their patients belonged to grades IV and V, and registering a fatality of 87.1%. The overall deaths for postabortal patients worked out to be 75.55%. Our study has been confined to a few cases, so that the results are indicative of trends only.

TABLE VIII
Analysis of Post-partum Cases

Grade	No. of cases	Recoveries	Deaths	Mortality percentage
I	3 H.D.*	3	—	—
II	—	—	—	—
III	2. 1 H.D. 1 Hos.D.*	2	—	—
IV	1 H.D.	1	—	—
V	2. 1 H.D. 1 Hos.D.	—	2	100
Total	8	6	2	25%

* H.D. — Delivery at home.

* Hos.D. — Delivery in hospital.

TABLE IX
Analysis of Post-abortion Cases

Grade	No. of cases	Recoveries	Deaths	Mortality percentage
I	—	—	—	—
II	2. 1 S* 1 I*	2	—	—
III	2. 1 S* 1 I*	1 I	1 S	50
IV	5 S (8 S*)	2	3	60
V	11 (3 I)	—	11	100
Total	20	5	15	75

I* — History of interference.

S* — No history of interference (doubtful).

TABLE X
Complications and Prognosis

Complication	No. of cases	Percentage of whole series	Fatal outcome	Mortality percentage
Pulmonary oedema	9	32.4	3	33.3
Any other lung complications				
Hyperpyrexia and toxæmia	3	10.8	2	66.6
Reaction to serum	1	3.6	—	—
Repeated spasms, convulsions and exhaustion	10	3.6	10	100
Respiratory paralysis	5	18	2	40

Pulmonary complications are unavoidable in victims of tetanus, and their frequency and danger have been emphasized for quite some time now (Editorial, Brit. Med. J., 1954). For prevention, intramuscular crystalline

penicillin was administered, a dose of 5 lac units every six hours; atropine was given to minimise bronchial secretions. Reid et al (1958) stress the importance of nursing these patients in the prone position. We have not followed this procedure, but the decubitus of the patient was frequently changed, and the upper respiratory tract aspirated as and when necessary. Generally, nasal feeding was discouraged because, in tetanus, "the larynx is no longer a watch-dog for the lungs" (Editorial, *Lancet*, 1954). Daily fluid intake was maintained at two litres, intravenous therapy was made use of, purely when the circumstances were unavoidable. In spite of these measures, pulmonary sequelae afflicted 9 patients and took toll of 3 of them. Exhaustion from spasm proved to be the finishing stroke for all the 10 sufferers. Of the 6 patients of respiratory paralysis, two died. Hyperpyrexia and toxæmia were noted in 3 patients, and proved fatal in 2 of them.

Mortality

Of our 28 patients, 18 proved fatal, a mortality of 60.7%, as compared with those recorded by Adams and Morton (1955) 75-100%, Hanna (1956) 50%, Weinstein and Beacham (1941) 57%, Patel et al (1960) 62.4% and Dave et al (1955) 59%.

Of the 28 cases reported here, 20 were of post-abortal origin, with a mortality of 75%. Figures recorded in the literature are Mattson and Starkey (1931) quoted by Maclean and Challen (1941), 91%, Dave et al (1955) 65.5% and Patel et al 75.5%.

Among the 8 postpartum patients, there were two deaths, a 25% morta-

lity; corresponding figures are those of Johnstone (1958) 60%, Jelliffe et al (1950) 60%, Dave et al (1955) 49% and Patel et al 46%.

Our results are in keeping with those of contemporary workers. It is realised that they may not be statistically significant because of the small number of cases in each category.

Prophylaxis of Puerperal Tetanus

Prophylaxis deserves prime consideration in the study of tetanus. Without doubt, puerperal tetanus is a preventable or nearly preventable disease (Hampton, 1954). Ramsey et al (1956) stated that their patient was the only one seen in the preceding 30 years at the Royal Free Hospital, London; during this time interval 6,000 patients of puerperal sepsis were treated. Adams and Morton (1955) were able to collect only 1 case in the previous 13 years. The specific immunotherapy has decidedly curtailed the incidence and mortality of puerperal tetanus. The foregoing figures probably represent the irreducible minimum. In India, however, the malady is still highly rampant. The reasons are obvious — poverty, illiteracy and lack of hygiene are the chief ones; among others may be mentioned religious bigotry, blind faith and superstitions. Consequently, the conditions are ideal for the practice of quackery and meddlesome midwifery crafts that are often exploited to the detriment of the patient; such inhuman conduct cannot be too strongly condemned. Success in eradication can only be achieved if the living standards and literacy are improved.

Specific prophylaxis against tetanus means the administration of anti-tetanus serum and/or toxoid. The toxoid is given at 3 spaced intervals, to all infants, and repeated as and when required. The serum confers immediate short-lived protection; some authorities, however, have raised doubts regarding its safety, utility and timing of injections. Serum sensitivity has led to anaphylaxis and even death. In cases of serious trauma, serum may need to be repeated in view of its short-lasting action and the proclivity of traumatised tissues to tetanus. If such a patient has had toxoid some years back, it is prudent to give both serum and toxoid now to make the most out of the situation. Another avenue of prophylaxis is immunization of all pregnant women with toxoid, with a booster dose during labour. Immunization is also essential when there is (a) a history of trauma, or of absence of asepsis and antisepsis, or of instrumentation of the genital tract, (b) a history of confinement or of miscarriage outside the hospital, with or without pyrexia, and (c) any patient suspected to be in danger of falling a prey to tetanus infection.

The main source of tetanus infection is the soil; our unshod population is also the more vulnerable because of lower limb injuries — a possible portal of entry — where no other origin can be traced (Johnstone, 1958). Avoidance of these injuries and others like punctured wounds, cuts with metals, secondary wound contamination, injuries to maternal soft tissues, neglect of wounds, etc., is an important step in the prophylaxis of tetanus.

The advent of penicillin has given us another weapon in the fight against tetanus. It finds use in suspect cases who have received specific immunotherapy because it is bactericidal. Moreover, it minimises secondary contamination, a factor that aids survival and multiplication of the tetanus bacillus.

Eradication of poverty and illiteracy are the prime measures that need to be launched in the war on tetanus. Increased urbanization and institutional confinements, provision of trained workers, strict maintenance of asepsis and antisepsis and better methods of sterilization have decidedly reduced the chances of tetanus infection. An attitude of complacency is unwarranted and may prove disastrous in the end. Prevention is indeed better than cure; there can be no greater proof of this than the non-prevalence of the disease today in the New World.

Discussion

Puerperal tetanus is one of the gravest complications that can befall the pregnant woman. Post-abortal patients are more dangerous than the post-partum ones because they are more prone to sepsis; a few represent illegitimate conceptions and quite a number are subjects of criminal interference. The criminal abortion patient is more exposed to the hazards of tetanus. A history of illegal interference is supportive, but lack of it does not rule out an induced miscarriage. The professional abortionist may be a quack, a qualified man or a dai. No matter who meddles with the pregnancy, the stakes are high in favour of septic-

mia, because there is a veil of secrecy surrounding the act. The interference generally consists of insertion of indigenous abortifacient sticks (we have collected a few of these), local injection of chemicals, use of laminaria tents, irritant pastes and the like. One of our patients paid a paltry five rupees for the complete operation performed in her own home. Another factor is the reluctance of patients to go to hospital, especially if they are unmarried and/or have resorted to illegal induction. After the intervention, these patients add to their misfortune by using rags as vulval pads, almost assuring a firm anchorage for tetanus bacilli. Even if the relatives are aware of the patient's pitiable plight, they either neglect her or are afraid to take her to the hospital. The result is that patients come to hospital only when seriously incapacitated by pain, bleeding, infection and shock. The stage is then all set for tetanus to do its worst. Contrasted with this, the post-partum victim is less serious; increased urbanization and medical facilities have contributed to the steep rise in hospital deliveries (Patel J. C. et al 1960); the chances of infection are thus markedly reduced. Overcrowding at homes and free confinements in general hospitals have worked towards the same end.

Puerperal tetanus is the bane of obstetrics in our land. Midwifery is still largely in the hands of the dai — an uneducated, unskilled midwife with no conception of sepsis. In the villages, the patient is given a raw deal. Clothing, at best a luxury, is used for both mother and baby for purposes of cleaning and dressing;

usually this means pieces of rags. Any delay in labour means meddling from the dai's unsterile hands. The cord is often cut by means of a stone; in one of our patients, a rusted knife was employed; it took the toll of both the mother and the baby. Ash, cowdung and manure — seeds for the soil — are also utilised in conducting a delivery. Even today, in the vicinity of our hospital, there are patients staying within and around stables and cow-sheds. Thus, even after they are discharged from the hospital, the constant threat of tetanus is for ever more. No wonder Knight (1933) said that "the marvel is that not so many die, but that so many live under this Spartan treatment! It is truly a case of survival of the fittest."

In hospital deliveries, the chances of infection are few indeed. However any manipulation, the use of catgut (formerly considered a causal factor, but not so now because of better sterilization methods) or any suture material, cotton wool dressings, etc., are likely causes. Also, native herbs may have been instilled locally in the vagina, prior to admission, either by the patient or by her relatives (Johnstone, 1958, and Jelliffe et al, 1950). Maclean and Challan (1941) emphasized the fact that, in any given patient, it is not always easy to point out the finger at the source of infection, because (i) a minor abrasion, of which the patient is unaware, may have healed, (ii) the organisms may have come from the patient's alimentary tract (Maclean and Challan, 1941, Duncan 1942); or (iii) an intramuscular injection may have caused the mischief

(Cole, 1942). These observations have the concurrence of the Tetanus Committee of the Royal College of Obstetricians and Gynaecologists (1941). Komaromy (quoted by Bush, 1941) brought out the fact that it is essential to determine whether the inoculation took place through other wounds, e.g., in the skin, and was merely coincidental with the abortion or delivery; obtaining this evidence is none too easy, to say the least. It has also been stated by Maclean and Challén (1941) that the incubation period may be shortened by an abortion, especially if it is an induced one.

It is not intended here to discuss the routine treatment of tetanus. It has been dealt with in a previous communication (Patel and Parikh, 1961). Features pertinent to the problem of puerperal tetanus are, however, considered here. The role of episiotomy in the post-partum patient has two aspects to it, viz. the use of catgut, and the proximity to the anal region (Johnstone, 1958). The placental site is also a plausible pathway. In our opinion, the episiotomy wound is of greater aetiological value than the placental site (S.N.G. had a case in private not included here). Tetanus infection may ascend via lacerated vaginal tissues. This can be substantiated only when smears and cultures are positive (Maclean and Challan, 1941). A foul vaginal discharge is strongly suggestive of the site of infection, but is not in the least diagnostic. These are the unknowns and variants which hinder information regarding the site of infection. If the infant does not develop tetanus, the mother might

have been infected from her own gut (Maclean and Challen, 1941). The neonate's bacterial flora also include tetanus bacilli, it is amazing that infection is so infrequent.

Wound debridement as a part of tetanus therapy is a time-honoured procedure, and is still advocated by many authorities. If this is applied to a puerperal case the natural question arises: What are the possible ways of wound debridement? Three methods have been applied: (i) dilatation of the cervix and evacuation of the uterine contents, (ii) evacuation of uterine cavity and intrauterine penicillin instillation, and (iii) hysterectomy. The rationale of uterine evacuation is that the necrotic tissue, rich in its content of tetanus organisms, is removed. This operation, however, is "probably dangerous, produces no benefit and should not be attempted" (Adams and Morton, 1955). A less severe procedure, which has found practical application, consists of gentle emptying of the uterus, followed by an instillation of penicillin solution locally. Our experience with this technique is too limited to offer any firm opinion. The rationale behind hysterectomy has been the removal of organisms localised to the uterus; once symptoms of tetanus set in, however, the offending agents have gone far beyond the uterus and got fixed to the nervous tissue. This is corroborated by experiments and studies on human autopsy material (Quenn and Banchart, 1953). Hysterectomy has received our serious attention, but it seems clear to us that it has no place in the post-partum cases. Post-partum tetanus cases are, however,

of a different kind. Here mostly the placental site is the hotbed of trouble, and the prognosis is poor indeed. Hence we wondered whether a hysterectomy would improve the prognosis in these cases. But realising that the toxin has already spread far beyond the uterus and also realising that these are poor-risk patients for major surgery, the idea was eventually given up. This is the logical conclusion when we realise that it will not only not save the patient but hasten her doom. The scanty literature available from Western countries is also of this view (Any Questions, *Brit. Med. J.*, 1956). The operation of hysterectomy is a major one per se and may turn the scales against the patient's life. Yet it is interesting to note that Quenn and Banchart (1953) have quoted French authors, stating that "in certain countries it was morally essential to perform hysterectomy on those patients and the procedure is still followed in some countries".

Summary

1. 28 cases of puerperal tetanus, seen from 1959 through 1961, have been analysed according to the classification of Patel and Joag (1959). The over-all mortality added up to 60.7%.

2. There were 20 cases of post-aborted origin, with a mortality of 75%, and 8 cases of post-partum variety, showing 25% deaths. This is parallel to the results given by other authors, although the series may not be large enough to be of statistical significance.

3. Factors of obstetric significance

have been considered against the background prognosis.

4. The importance of prophylaxis has been stressed.

5. Special features in the treatment of puerperal tetanus are discussed.

Acknowledgement

We thank our colleagues and the hospital authorities for their kind co-operation in preparing this study and for the permission to publish this article.

References

1. Adam J. Q. and Morton R. F.: *Amer. J. Obst. Gyn.*; 69, 169, 1955.
2. Any Questions: *Brit. Med. J.*; 1, 585, 1956.
3. Cole L.: *Brit. Med. J.*; 2, 550, 1942.
4. Dave B. T., Satoskar R. S., Joag G. G., Patel J. C. and Lewis R. A.: *J. Postgrad. Med.*; 1, 4, 1955.
5. Duncan A. T.: *Brit. Med. J.*; 2, 426, 1942.
6. Editorial: *Brit. Med. J.*; 1, 446, 1954.
7. Editorial: *Lancet*; 2, 175, 1954.
8. Hampton O. P.: *Amer. J. Surg.*; 87, 47, 1954.
9. Hanna W. A.: Letter to the Editor, *Lancet*; 2, 1048, 1956.
10. Jelliffe D. B., Walker A. H. C. and Mathews S.: *Brit. Med. J.*; 2, 814, 1950.
11. Johnstone D. D.: *Brit. Med. J.*; 1, 12, 1958.
12. Knight (1933): Quoted by Shackleton P.: *Brit. Med. J.*; 2, 155, 1954.
13. Knott and Cole: Quoted by Patel J. C. and Joag G. G., 1959.
14. Komaromy: Quoted by Bush F.: *J. Amer. Med. Ass.*; 116, 2750, 1941.

15. Maclean B. and Challen P.: *Brit. Med. J.*; 2, 302, 1941.
16. Mattson and Starkey (1931): Quoted by Maclean and Challen, 1941.
17. Moynihan N. H.: *Brit. Med. J.*; 1, 260, 1956.
18. Patel J. C. and Joag G. G.: *Ind. J. Med. Sc.*; 13, 834, 1959.
19. Patel J. C., Mehta B. C., Dhirwani M. K. and Bhandarkar S. D.: *J. Obst. Gyn. India*: 2, 188, 1960.
20. Patel L. R. and Parikh N. K.: *Jour. J. J. Gr. Hosp.*; 1961.
21. Quenn and Bancharts: Reviewed in *J. Obst. Gyn. Brit. Emp.*; 60, 745, 1953.
22. Ramsay A. M., France E. M. and Depmsey B. M.: *Lancet*; 2, 548, 1956.
23. Reid M. A., Bowler D. D. and Scott L. T.: *Brit. Med. J.*; 1, 772, 1958.
24. Tetanus Committee of the Royal College of Obstetricians and Gynaecologists (Quoted by Maclean and Challen, 1941).
25. Weinstein B. B. and Beacham W. D.: *Amer. J. Obst. Gyn.*; 42, 1031, 1941.