Thesis
on
The Interscapulo-Thoracic
Amputation
For
The Degree of Doctor of Medicine
By

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This is to certify
that

Mr A. D. Mackinnon
M.B., C.M. (Dun.) took out
the Medical & Surgical Practice
at the London Hospital in Oct. 1892,
until May 1893. Since that
time he has acted as my
Assistant, & will continue to
do so till August of this year.

W. Murray Leslie
M.D., F.R.C.S.E.

I, Adam Henry Muir Macmorran, Bachelor of Medicine and Master of Surgery of Edinburgh University, do hereby declare the following Thesis to have been composed entirely by myself and to have been compiled without assistance other than that named within the same.

Witness my hand

A. H. Muir Macmorran

This 27th day of April 1894

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A Thesis

on

The Interscapulo-thoracic Amputation

This has seemed to me a fitting subject for a thesis for the degree of Doctor of Medicine of the University of Edinburgh for many reasons, some of which I may enumerate:
Firstly, it was an Edinburgh surgeon who first performed an operation similar to the above named, and placed it upon the Hospital records as a possible, justifiable and necessary one in certain cases, though he laid down no definite lines to guide other surgeons in a like attempt. Mr. Syme, to whom I refer, performed this operation,- as he did many others which have been, more or less, handed down to posterity,- with one end in view, exercising his keen judgment and great skill, entirely for the greatest benefit,

safety and welfare of his patient.
Secondly, though an operation of recent times, I believe it will quickly gain favour with surgeons in this country, more particularly in Edinburgh, where towards the end of my curriculum as a student, I first heard it advocated as an operation of the future, which might eventually supplant, in a considerable number of cases at least, the more familiar one of amputation through the shoulder joint.

Structures removed. Arm, scapula, and clavicle.

The interscapulo-thoracic amputation is the removal in one piece, of the whole upper extremity including the clavicle and scapula, or, as Mr. Treves terms it,- the removal of the whole forequarter, by a flap operation,- an operation, which, to one hearing of it for the first time, must seem very formidable, but which, I hope to show, is a better and even, a safer one in certain cases, than that of amputation through the shoulder joint; and

it was for this reason I devoted some time to study the results of the cases already published and of those brought more closely under my observation in hospital. It has been an interesting study to me, because at first the performance of it seemed at variance with some of the great fundamental principles of Surgery which I have been trained to recognise as inviolable in the mind of a good practical surgeon; such I have found not to be the case; and I now believe that before long this operation will be taught in our medical schools and Universities as one of primary importance, and moreover, that it will soon find a prominent place in our Manuals and text-books on Surgery, from which, at present, it is conspicuously absent.

History of the operation

The history of the operation is as follows:—

As early as 1863,

Mr. Syme removed the whole of the structures of the upper extremity at one sitting, viz. arm, scapula and clavicle, proceeding by first amputating through the shoulder joint and then excising the scapula and clavicle,- a tedious and difficult task. He was followed two years later by Sir William Fergusson, who performed a similar operation with this difference,- that he had previously excised the scapula; Dr. Heron Watson performed the operation successfully in 1869. But it was not till 1882 that the operation known as the Interscapulo-thoracic amputation of modern times was first performed upon definite lines, and to M. Paul Berger the Parisian surgeon must belong the credit of having been the first surgeon to achieve this, in the manner which I shall describe below, and discuss in detail.

Mr. Syme 1863

Sir William Fergusson 1865

Dr. Heron Watson 1869

M. Paul Berger 1882

I had the privilege, while taking out the medical and surgical

practice of the London Hospital in 1892-93, of hearing Mr Frederick Treves advocate this operation in preference to that of amputations at the shoulder joint, and of seeing his results in more than one case, and this gave me an incentive to study the literature on the subject, and to compare as far as possible the results of the different operations in the region of the shoulder joint.

An amputation by two flaps

The amputation as described by Mr Treves differs somewhat from that described by M. Berger but not to any important extent, and it is the description with which I am most familiar after having seen Mr Treves carry it out successfully, and after hearing him describe it several times to his senior clinical class. The operation is one of a simple straightforward character, ~~by~~ and is essentially one of amputation by two flaps.

The steps are as follows:— Steps in the operation

I The Formation of a Pectoral Flap;— I A pectoral flap

to accomplish this the clavicle is Preliminary incision to clear the clavicle and tie the main vessels.
first exposed and cleared of tissue,
an incision is begun one inch
external to the sterno-clavicular
articulation and carried along the
clavicle to the articulation of that
bone with the acromion process;
the clavicle is cleared of tissue by
means of a Farabeuf's rougine
which greatly simplifies, as Mr. Treves
points out, an otherwise difficult
task such as clearing the bone with
a knife; the clavicle is then divided,
at the level of the commencement of
the incision, by means of a saw, or, if
one is familiar with the use of the
instruments, preferably with a chisel
and mallet; next the subclavius
muscle is divided,— the subclavian
artery and vein are exposed and
secured at the third part by a prox-
imal and distal ligature and then
divided. Next the surgeon

proceeds with the pectoral flap,- by an incision beginning about the middle of the former, and carried downwards and forwards to the anterior fold of the axilla, and then by the shortest route to the angle of the scapula.

The Pectoral Flap

II "The Posterior or Scapular Flap:- Beginning the incision where the first one ended,- over the acromio-clavicular articulation,- the knife is carried backwards and downwards slightly curving over the posterior fold of the axilla to meet the anterior incision at the angle of the scapula.

II A scapular flap

"The pectoral flap is made first, by reflecting the skin, dividing the pectoralis major and minor and latissimus dorsi muscles, then the cords of the brachial plexus come into view and are severed, and now the limb is held only by the muscles which attach the scapula to the trunk. Rolling the patient

Tissues divided in making the pectoral flap

over, drawing the arm forcibly across the chest, the patient being at the edge of the table, the surgeon makes the posterior or scapular flap, by reflecting the skin to the posterior border of the scapula,- dividing the trapezius, levator anguli scapulae and the rhomboid muscles, and the limb is taken away.

Tissues divided in removing the limb.

"The previous ligature of the third part of the subclavian artery has restrained all haemorrhage, except that from the posterior and supra-scapular arteries which come off the main vessel at a higher level, viz. from the second part; this is easily restrained however, and the wound is closed by approximating the flaps, admitting of most perfect drainage from the most dependant part and without tension; the wound heals rapidly, as a rule, by first intention. In an article published in "the Lancet" by Thomas F. Chevasse M.D; F.R.C.S. the advantages claimed

No haemorrhage

Perfect drainage

"Lancet" August 27. 1892 Vol II No IX

for the operation are:- prevention of excessive haemorrhage, and of air entering the vein,- free division and removal of soft parts in tumour growth,- rapid healing and excellent drainage, leading to speedy convalescence.

Such being the case, the operation is well worthy the consideration of surgeons, as these advantages in my opinion cannot be claimed with any degree of certainty, in other operations in this region;- the skilled surgeon can, in the latter as a rule, restrain excessive haemorrhage, and he may get rapid healing, but the degree of certainty that he will get efficient drainage, and rapid convalescence is by no means great, indeed, the results of my research have pointed rather in the other direction, and in amputation through the shoulder joint I have found that the progress

Comparison with other amputation

of the cases is always a matter
a matter of anxiety to the surgeon
and many cases that have
ended fatally, leave room for doubt,
in my own mind at least, if
amputation through the joint
was the best and safest method
that could have been adopted;
while I am convinced that for
cases of tumour growth implica-
ting the joint and soft structures
round it, there is only one operation
that is effective, viz. that of removal
of the whole forequarter by the
method advised by Berger; and
a comparison of the cases,- so far
of course limited in number,-
with those of the best recognised
modes of operating through the
joint, has led me to believe, that
of the two classes of operation, one
is a simple straightforward one
comparatively safe, the other, a
difficult one, always attended
with more or less danger at

Effective in cases of tumour growth involving joint.

the time, and with many drawbacks during convalescence which is always slower, and as often unsatisfactory from other causes as not; and the former description is the one which I have found to apply in almost every case to the interscapulo-thoracic amputation. My reasons for this opinion I shall give more in detail.

Comparison with Spence's & Larrey's operations & others

Of the amputations through the shoulder joint, there are two methods which are generally considered the best, viz. Spence's and Baron Larrey's methods, and these are the two I have selected to compare with the interscapulo-thoracic. In nearly all the descriptions of Spence's and Larrey's operations, the chief advantage claimed for each is,- "less risk of haemorrhage",- tacitly admitting such risk to a greater or less extent, while in other methods

such as that by the double flap and that by the large deltoid flap, there is considerable loss of blood from the necessary early division of the circumflex vessels especially the posterior circumflex artery, this may endanger life or may cut off the nourishment of the deltoid flap, and in other ways retard convalescence.

Dangers of the double flap & large deltoid flap modes

Both Larrey and Spence recognised these dangers, and tried to obviate them, a task which they did accomplish, as far as the circumflex vessels were concerned, and got better results in consequence; other advantages are good drainage, cut surface and cicatrix small, and the good form of the stump. While further advantages in favour of Mr. Spence's method are;- disarticulation is made very easy, and in disease of the joint, the latter can be explored previous to amputation or excision can be carried out

Advantages of Spence's mode

without amputation.

Now in the interscapulo-thoracic amputation, the risk of haemorrhage is almost entirely removed by the ligature of the subclavian vessels, similarly the risk of air entering the vein. I have seen the operation performed and throughout, after ligature of the main artery and vein, it was found necessary to use only four pairs of artery forceps and when these were removed only two vessels required ligature; I have heard Mr Treves say he had performed this operation without tying but one vessel after the main trunks. As far as drainage is concerned it could not be better effected than in this method while disarticulation is avoided altogether, and this is, I believe an important factor in the very rapid recoveries often experienced after this operation; two noteworthy examples of rapid recovery are published by Mr.

Advantages of Berger mode.

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Frederick Treves,-one, in which there was a malignant growth involving the shoulder joint and in which the patient got up a fortnight after the operation and left the Hospital on the twentieth day;- the other was a case of recurrent schirrus cancer, in which the operation seems to have been one of great difficulty, yet the patient was able to sit up out of bed on the ninth day, to be out in the garden after fourteen days, and to return home after three weeks.

In cases of advanced disease of the joint, the anterior incision,- Spence's preliminary incision,- is no bar to the performance of amputation by Berger's method, if necessary; as it would not affect the pectoral flap at all.

But what about shock and pain after operation?- very important factors, all will admit. It strikes me at once, that none of the methods of amputation through

No shock

the joint claim an advantage over another on the points of 'less shock' or 'less pain' while the records of all of them show that shock and pain are considerable, and a fairly high percentage of cases never rally after operation. It is here however, that the Interscapulo-thoracic method appears to best advantage for shock in that operation is actually trifling; I shall return to this when I discuss in detail the cases published by Berger in his book. Pain is not severe after operation, as I have seen for myself in several cases, and Mr Treves says, he never injects morphia in those cases because it is not necessary.

No pain. No morphia required.

It seemed to me a remarkable assertion on the part of a surgeon in the habit of performing major operations of all descriptions every week, that there is practically no shock in an operation in which

so large a portion of the body is removed and so many very important structures severed and I have devoted much attention to this point, having for this purpose, studied a great many published cases besides those I have seen myself together with the valuable testimony which Berger gives in his book on the subject; and I have found the statement to be substantially accurate in every respect. Nor does it seem so remarkable that shock should be slight after operation, when one takes into consideration authentic cases of accident, where the arm has been torn off together with scapula and clavicle, in many of which there has been no shock whatever, the haemorrhage having been spontaneously arrested by retraction of the torn vessels. Perhaps the most remarkable case I am acquainted with, is one the details of which have been kindly put in my possession by the

when Rogers' ten cases erican Journal Medical Sciences Vol LVI

No shock after accident tearing off upper extremity

Dr. W. Murray Leslie's case.

gentleman to whom I have had the privilege of acting as assistant and 'locum tenens' during the past year,- Dr. W. Murray Leslie of Cubitt Town,- who was hastily summoned one day to see a lad who had been injured in the United Horse Shoe Company's works; he found at the scene of the accident the whole upper extremity including the scapula and portion of the clavicle lying at some distance from a large wheel which had caused the injury, and on looking round for the patient, he was in time to see him walk down to the river-side where he went on board the Ferry-boat and crossed to Greenwich Hospital; he made a rapid and complete recovery having lost practically no blood.

So far I have dealt with this subject on general terms, but to estimate the value of an operation it is necessary to watch not only

the immediate results but also the ultimate results, and it is very important to study in detail the good with the bad and to determine the causes that influence the termination in each case; the consideration of accidents during and following operation is also of great importance; and it is in the admirably written treatise on this subject by M. Paul Berger that I have found details of an ample number of cases, upon which I may base a sufficiently sound judgment and which have only strengthened my previous convictions as to the value of this operation. One objection, however, I have to Berger's otherwise admirable collection of cases, taken as they are from the principal hospitals of many countries, and that is, that he includes with interscapulo-thoracic amputations proper, other cases which he terms "amputations consecutives," ie. cases where the arm and scapula

mputation du
bre supérieur dans
étiquité' du trone"
ided in Paris
1884
Paul Berger.

Details of cases in Berger's book

An objection
inclusion of cases of
"amputations consecutives"

are removed at different times, while he himself points out that the patient runs the same risk each time that he would have done if he had undergone complete removal of the forequarter at one sitting;- to quote his own words :-

"On voit donc que le malade sur lequel il faut practiquer l'amputation consécutive de l'omoplate quelque temps après la désarticulation de l'épaule encourt les mêmes risques que s'il allait subir l'amputation du membre supérieur avec l'omoplate, en plus de ceux auxquelles il a été exposé par le fait de la désarticulation du bras."

Quotation from Bergers book No. 1.

The mortality would be much less but for the above inclusion; but the author evidently wishes to give a complete list, in order to form an unprejudiced opinion on the value of an operation of which he is an important advocate

Altogether, the book contains

details of fifty cases, these he very properly divides into, those operated upon for tumour and other pathological causes, and those operated upon for accident.

Results of 50 cases

Of 37 pathological cases, details of which are given 7 only proved fatal while of 13 cases of accident 4 died; or 19·05 per cent - rather less than one fifth of the pathological cases, and 30·7 per cent of the accident cases - rather less than one third, proved fatal; but Berger modifies the percentage of deaths under the latter category as I shall show later; the injuries received at the time of the accident have no doubt hastened the death in some cases but the author very fairly accepts the number of deaths without reserve

37 Pathological cases 7 deaths or 19·05%

13 Accident cases 4 deaths or 30·7%

Of the seven fatal pathological cases Two died of shock (cases published by McLeod and wood)
One of Haemorrhage (Macnamara's)
One of Exhaustion (Krakowitser)
Two of Septic complications, viz. those

Causes of death in the 7 pathological cases

published by McGill and D'Ambrosio; while in Fergusson's case no cause of death is indicated

Causes of death in the 4 traumatic cases

Of the cases of death in operation for accident;-

Two died from the immediate effect of the accident

One of Concomittant lesions

One of traumatic pneumonia

A modified death rate in traumatic cases

Berger goes on to say:- "If we except the cases where other lesions, sufficient to cause death existed besides that necessitating operation, (as shown at the autopsy) of the eleven cases observed a proportion of rather less than one fifth were fatal; and therefore the same as that for pathological cases;"- and his summing up, is as follows:-

Quotation from Berger's book No. 2.

"L'examen que nous venons de faire des causes qui ont amené la terminaison fatale à la suite de l'amputation interscapulo-thoracique nous permet dés à present d'affirmer que le pronostic de cette operation est en realité plus favorable que le resultat des cas

publiés jusqu'à present ~~d'aujourd'hui~~ ne l'indique et que la proportion des ses succès ne peut que s'accroître par la suite. C'est ce qui va ressortir plus nettement encore de l'etude détaillée des accidents et des complications qui se produisent au cours de cette operation ou qui eut out été la consequence et dont quelques-uns, grace aux moyens dont nous disposons, peuvent désormais être prévus, évités ou combattus avec la certitude du succés."

Now if we go into the accidents recorded in the different cases we find:

A Immediate Accidents.

Accidents. I Immediate

I. Haemorrhage. There are only 3; McLeod's was probably due to too low ligature of the artery. Macnamara's was due to numerous dilated veins in the field of operation; while Allier's was due to slipping of the ligature on the artery.

II Entrance of air into the veins. Also three cases of which only one died.

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III Shock. This must be taken into serious consideration; Chevasse says in his paper before alluded to, that youth is no bar to this amputation.

Cases unfavorable for operation

Cases of old people or of those already prostrated by illness or shock of accident, likewise cases where large and vascular neoplasmata have to be dealt with present certain difficulties, which the surgeon has to decide upon before operating, and having decided he should be prepared to encounter and overcome them. In every major operation difficulties occur which could not have been foreseen by the surgeon, such constitute the greatest risks the patient has to undergo in most cases.

But I have endeavoured to show that in this operation by far the majority of cases evince a degree of shock, proportionately much less than might reasonably be expected from the magnitude of the operation.

B Accidents following operation and complications. 2 Subsequent accidents and complications

These resolve themselves into two of which, fortunately we see very little nowadays. I Inflammation II Sepsis. There are two recorded in Berger's book.

Of these accidents, which, as I have said, have to be reckoned on in all major operations, none ought to have a deterrent effect upon a surgeon, anxious to do his utmost to preserve his patient from death or from risk of possible further surgical interference in the future. Haemorrhage is amply guarded against by the double ligature of the subclavian artery and vein at the third part, and by the use, where necessary afterwards, of haemostatic forceps. The same is applicable to risk of air entering the veins.

Secondary complications ought not to occur, with the perfect means at our disposal of operating II Secondary

antiseptically, and of preserving the wound antiseptic after operation.

Berger, after criticising the causes of death and the accidents in the cases he publishes concludes as follows:-

"Il n'en reste pas moins acquis en envisageant les faits dans leur ensemble, que l'amputation du membre superieur dans la contiguité du tronc se presente comme une operation peu grave, dont la mortalité général ne dépasse pas la cinquième des cas, et dont les resultats pourront être plus favorables encore, lorsque son manuel operatoire sera mieux reglé, plus connu, et qu'a la securité plus grande qui résultera des perfectionnements apportés a son execution l'on joindra la bénéfice que donne l'application rigoureuse de la methode antiseptique."

Hitherto I have considered this operation from the point of view of success or failure, but

that is not all one wishes in amputations;- the surgeon aims at a good result from the point of view of,- as little deformity as possible, and this is a very important consideration. Almost the first questions that arise in one's mind in the contemplation of this amputation are:- Will there not be great deformity after so much has been removed from one side of the body?- and,- Will the balance of the body not be lost or impaired? I may say at once that we cannot hope to get a full rounded stump with small cicatrix such as is got after a Spence, but I am bound to say that the deformity is very much less than I expected to find, and certainly in the cases I have seen, the patient has had no complaint to make with regard to loss of balance of the body. I saw a young woman in the operating theatre of the London

Deformity. Not great
No loss of balance

Case seen in London Hospital 1893

Hospital, Whitechapel. E. upon whom Mr. Treves had performed the operation of interscapulo-thoracic amputation, and who had returned to hospital for what was supposed to be a recurrence of the tumour for which the operation had been carried out, and I was surprised to see so little deformity,- there was a long straight cicatrix, but one had to look pretty closely before one recognised that more than an ordinary amputation had been performed. I saw the same patient afterwards, walking about, she was perfectly erect and walked well, indeed, it was almost impossible to tell that anything more was out of the common in her appearance when dressed, than that she had lost an arm, the shoulder of her dress was padded so as to make up for the deficiency.

Long almost straight cicatrix

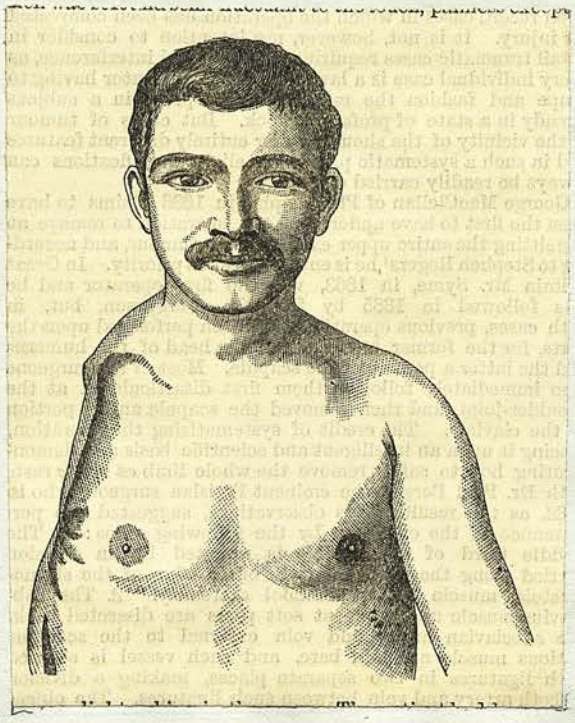
Shoulder of coat or dress may be padded

Of course it must be understood that the result will vary, with any modification of the flaps, it may

be deemed necessary to make, as in cases of tumour growth involving the skin, but as a general rule deformity is not so great as to have much influence on the operation one way or another, (though it would so if the advantages of operating by this method were less pronounced) and very often the result is exceedingly neat and compact.

Deformity modified by flaps, made.

Copy of photograph from "Lancet" Aug 27 1892



The above is a copy of a photograph taken from Mr. Chevasse's cases and published in the Lancet, it had evidently been taken very soon after the wound

had healed. The cases I have seen show even better results, especially that of Mr. Treves to whom I have alluded on the opposite page; the fulness of the breast and mammary gland modifying the general appearance of the scar to a remarkable degree; unfortunately I have been unable to obtain a photograph of this case.

Having thus dealt with the various points in detail, which it is usual and necessary to consider in major operations, viz. Haemorrhage, shock, pain, deformity, I need only briefly allude to the cases in which this operation ought to be practised.- Syme left it entirely in the discretion of the surgeon when to operate by removing the whole of the structures of the superior extremity; he also left it entirely to the originality of the operator how to achieve his object, forgetting for the time, as most men, who have a great fund of resource, do forget, that the majority of surgeons

Cases where the Interscapulo-thoracic operation is advisable

might not possess the same amount of originality and resource in operating as he had himself and that, to no ordinary extent. Berger laid down certain rules to regulate the performance of this amputation; and other surgeons by publishing their successes and failures will assist in the future ~~in the future~~ in the determination of the cases in which the interscapulo-thoracic amputation ought to prove the best.

I have already said that, for neoplasmata, whether simple or malignant, in the region of the shoulder joint, or, in the case of the latter form, involving the scapula and affecting the axillary glands there is only one operation which will give satisfaction and that is Berger's operation

Cases of tumour

For traumatism, I believe amputation through joint ought not be practised:- 1. Where there is uncertainty as to securing sufficiently healthy flaps, and sloughing is at all likely to occur; there is then risk of sepsis and of septic absorption

Traumatic Cases.

which will retard recovery and may even cause death.

2 Where good, free drainage cannot be assured; it must be remembered that after disarticulation there is a large space to fill up in the glenoid fossa, and if that is not accomplished by accurate pressure and a good flap tension must result.

In conclusion, I cannot help thinking that the act of disarticulation causes more shock in amputations through the shoulder joint; if I were asked for an explanation why that should be, I should have to acknowledge that I could advance none that would be entertained by physiologists as possible or perhaps even feasable. But certainly the systematic study operations in this region and a comparison of those which require interference with the joint with those which require no such interference, point at least in the direction of a statement such as I have made above though with all

Conclusion.

deference.

However little merit I may claim, as far as originality is concerned in the foregoing thesis, I venture to hope it may meet with approval, if I have succeeded in demonstrating the great importance of the Interscapulo-thoracic amputation, as well as in showing that it stands favorable comparison with most major operations; while in advancing the belief that it will in course of time be considered one of standard importance in our medical schools, where in the hands of skilfull surgeons, the results obtained will be even more satisfactory than those I have given above, I am convinced that this operation will yet be used in many cases in preference to amputations through the shoulder joint, as the performance becomes more familiar to us. The aim of surgeons to carry out the great fundamental principle of Surgery,- to achieve the best

results with the least deformity, consistent with a due regard for the safety of the patient,- is no less today than it has ever been; and the records of the interscapulo-thoracic amputation, including as they do, cases where disaster need never have happened, and others where accidents, though few in number, have occurred, but which in future ought to be efficiently safe-guarded can only lead to the belief that that great principle not only need never be broken but ought even to be furthered by the operation which Berger and others have performed with so much success.