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Revision tympanoplasty*

by

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Summary

The terms 'planned two-stage operations', 'planned second-look operations', 'previous surgery', and 'revision surgery' are discussed on the basis of our series of 2,303 ears operated upon from January 1965 to December 1980. We have not performed any *planned* two-stage operations. All operations prior to the first operation in our department are denoted 'previous surgery'. 'Revision surgery' denotes all reoperations performed either in this department or elsewhere during the observation period until the end of 1984, and the revision rate is analysed in patients with different pathological conditions. 'Revision surgery' was performed in 15.6 per cent of 740 ears with cholesteatoma (in 13.9 per cent once, in 1.6 per cent twice, and in 0.1 per cent three times), and 'previous surgery' in 3 per cent.

Among 229 ears with chronic granulating otitis, revision surgery had been performed in 12.2 per cent up to December 1982. By December 1984, this figure had risen to 16.1 per cent. 'Previous surgery' had been performed in 18.3 per cent. A total of 38.4 per cent had at least two operations.

The revision rate in other conditions varied from 10 per cent (sequelae to chronic otitis) to 34 per cent (post-inflammatory acquired atresia). These rates are discussed and the functional results presented.

Introduction

This paper attempts to present some general views on the revision rate in tympanoplasty. Revision tympanoplasty, or reoperation, probably constitutes the most frequent type of tympanoplasty, but, at the same time, it is the one most poorly defined, being perceived differently by the patients and by individual surgeons.

The patient and revision procedures

To the patient all repeated procedures are regarded as revisions and the total number of these may become considerable. For instance, after the first CAT at a planned second-look operation (indicating residual disease), a planned third-look operation will be made, which is in fact the second revision (Fig. 1). The third reoperation is performed because of recurrent cholesteatoma and results in a conservative radical operation, occasionally also in two stages. The ensuing operation (fifth revision) is a total reconstruction of an 'old' radical cavity indicated because of cavity problems. This procedure may also require two stages. All of the following revisions will be tympanoplasties with the aim of improving hearing. During a period of 5 years the patient may have 6-7 operations without having serviceable hearing at any time (Fig. 2).

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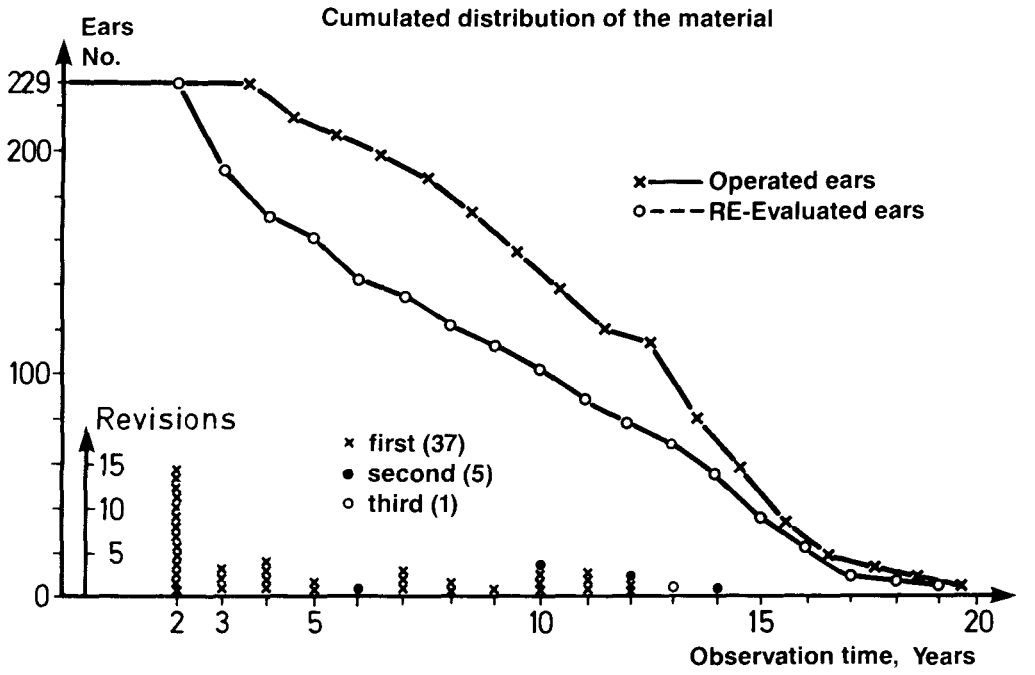


FIG. 1

Examples of divergent views on 'previous surgery' and 'revision surgery' in two hospitals treating the same ear during an observation period of 5 years. Hospital A regards as 'previous surgery' all procedures prior to the operation for cholesteatoma; three years later all ensuing operations are regarded as 'reconstruction of old radical cavities', although the patient had had previous surgery in the same hospital.

Many patients are surprisingly willing to accept the offer of reoperation and in many instances the surgeon may feel himself pressed to offer it. The surgeon's main task is often to convince the patient that such a procedure will not lead to lasting improvement of hearing.

The surgeon and revision procedures

Several of the above-mentioned procedures are not considered revisions by the otosurgeon, especially not the *planned* procedures and those performed prior to *his first* operation. The latter are at most recorded as *previous surgery*. Not even reoperations by the same surgeon are always considered as revisions; for instance, a hearing-improving reconstruction of the tympanic cavity performed some years after a conservative radical operation. The following distincton can be made between the various types of reoperations:

(1) *Planned second-stage operations*, such as second-look procedures following CAT operations in cholesteatoma (to exclude residual cholesteatoma), as sincerely recommended by some surgeons (Sheehy and Crabtree, 1973; Smyth, 1976, 1980). Actually, the CAT operation is directly advised against in cholesteatomatous ears before the patient's acceptance of reoperation has been obtained. Many surgeons do not regard this kind of intervention as revision, or failure, but rather as an alternative method in the treatment of cholesteatoma. Another field for planned two-stage tympanoplasty is severe pathology of the mucosa in the tympanic cavity (Tabb, 1963; Austin, 1969; Smyth and Kerr, 1970).

(2) *Previous surgery* may include: (a) all operations prior to the present pathological condition; (b) all operations prior

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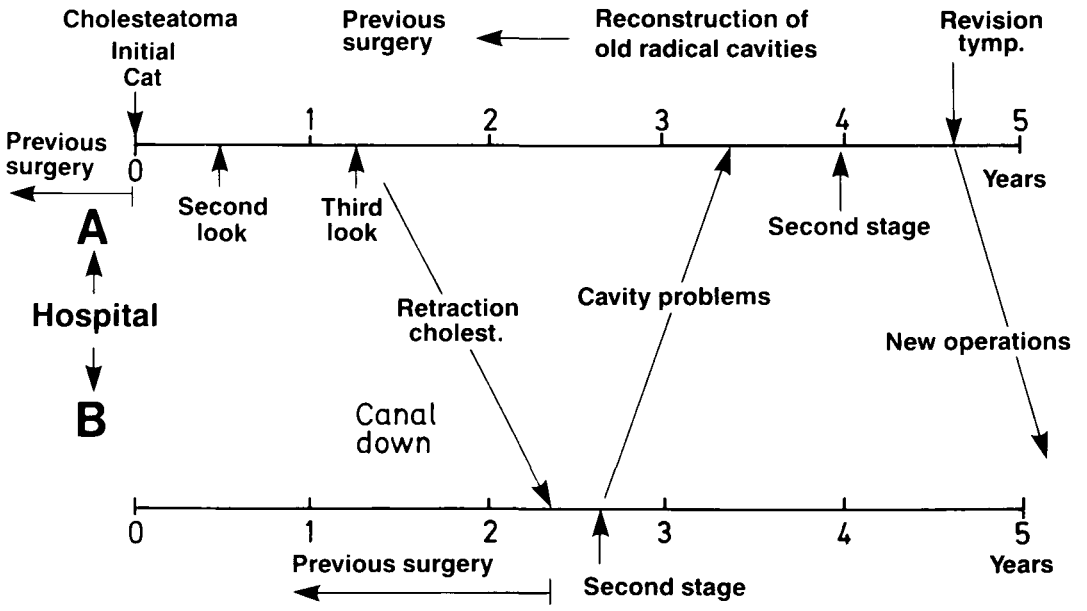


FIG. 2

Cumulated distribution of 229 ears with chronic granulating otitis. Number of re-evaluated ears and of operated ears during a period of 20 years.

to the present operation, the course of which will be followed regardless of where and by whom it is performed; for instance, all operations preceding the first operation for cholesteatoma, if it is the course of cholesteatoma surgery that is being evaluated, or all operations preceding reconstruction of old radical cavities if that is the procedure at issue; (c) all surgery performed in other hospitals. This even includes actual revision operations, such as revision in cholesteatoma, or myringoplasty in cases with reperforation where prior attempts to close the perforation have been made elsewhere; (d) all surgical interventions performed by other surgeons are regarded by some surgeons as previous surgery.

(3) *Revision surgery* may randomly be chosen to denote any operation not included in the categories 'staged operations' or 'previous surgery'. The uncertainty of terminology thus lies in the distinction between 'revision' and 'previous surgery'. Obvious revision surgery includes: (a) reoperation of residual cholesteatoma; (b) closure of reperforations of eardrums occurring in direct connection with one's own myringoplasty; and (c) an immediate re-ossiculoplasty performed in the absence of hearing improvement. If, for instance, reperforation occurs in connection with acute otitis 5 years after successful myringoplasty, it is doubtful whether closure of this perforation will be called revision tympanoplasty. Thus, the distance in time to the preceding operation is critical in deciding whether the intervention is regarded as revision surgery or as the first operation of a new pathological condition.

In the following, we will discuss the frequency of revision surgery and the many problems involved in such a calculation. Similar reports do not appear to have been published previously.

Material and results

The material has the following characteristics: (a) It comprises all ears subjected to operation for chronic otitis and its sequelae

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from January 1965 until December 1980,—a total of 2303 ears (Table I). The revision rate was determined in December 1982, and the observation period thus ranges from at least two to 18 years; (2) all operations have been performed in one stage since we do not perform staged tympanoplasty; (3) all surgery following the first intervention is denoted revision, regardless of where and by whom it was performed; (4) the calculation of the revision rate is not based on the performance of a single surgeon, but on all of the operating staff, including residents; (5) 'previous surgery' includes all operations performed *elsewhere prior to* the first operation in our department; (6) the diagnoses listed in Table I refer to our first operation, and not to revision surgery. If, for instance, the patient has a primary operation for cholesteatoma followed by myringoplasty 10 years later, this is denoted 'revision following cholesteatoma'; (7) some of the patients in this series have been re-examined several times. Thus, patients with cholesteatoma were seen at follow-up in 1968, 1972, 1976, 1978 and lastly in January and February 1981. Patients with other pathological conditions were seen at other times.

Each follow-up examination included more patients than the preceding one and increased the length of follow-up. All revisions in our department and elsewhere during the observation period were recorded and evaluated. For all disease entities, a complete record of information on all revisions, and until December 1982 all revisions made in our department, is thus made available before each follow-up examination. The longest observation period was 18 years for the first operation in 1965.

Cholesteatoma

As mentioned, patients with cholesteatoma were last seen in January and February 1981, i.e. with a maximum observation period of 17 years. Until 1978, 636 ears had received a primary operation for acquired cholesteatoma. Reoperation was performed at least once on 98 ears (15.4 per cent). Ninety-four per cent of the patients were re-examined at least once, with an observation period ranging from 3 to 17 years; patients who were not seen at follow-up did not deviate from those attending, so that the revision rate can be considered reasonably realistic. Hearing was

TABLE I

PERCENTAGE OF REVISIONS JANUARY 1965–DECEMBER 1982

Conditions operated 1965–1980	Total No.	Revisions One %	Two %	Three %	Total %
Cholesteatoma, attic	273	9.2	0.7	—	9.9
Cholesteatoma, sinus	271	16.2	3.0	0.4	19.6
Cholesteatoma, tensa	196	18.2	1.0	—	19.2
Cholesteatoma, total	740	13.9	1.6	0.1	15.6
Chronic granulating otitis	229	12.2	—	—	12.2
Sequelae to chronic otitis	759	9.1	0.5	—	9.6
Tympanosclerosis	73	9.6	2.7	—	12.3
Adhesive otitis	105	5.7	—	—	5.7
Obliterative otitis	14	7.1	—	—	7.1
Seqv. to otitis and otosclerosis	20	20.0	—	—	20.0
Radical cavity reconstructions	261	14.9	1.0	—	15.9
Postinflammatory acquired atresia	23	30.4	4.3	—	34.7
Traumatic incus luxations	56	12.5	—	—	12.5
Traumatic drum rupture	6	—	—	—	—
Congenital malformations	17	23.5	5.9	—	29.4
Total ears	2303	12.0	1.1	0.04	13.1

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TABLE II

ALL CHOLESTEATOMAS PRIMARILY OPERATED UPON FROM JANUARY 1965 TO DECEMBER 1978 AND REVISED FOR DIFFERENT REASONS FROM JANUARY 1965 TO FEBRUARY 1981.
AIR-BONE GAP IN EARS WITH ONE OPERATION OR REOPERATION

Air-bone gap dB	One operation		Two or more operations	
	Preoperative No=524 %	Last evaluation No=524 %	Preoperative No=98 %	Last evaluation No=98 %
0–10	4	35	4	15
11–20	14	28	8	34
21–30	27	22	19	24
31–40	28	9	28	17
>41	27	5	41	10

p<0.001 — p<0.001
n.s.
p<0.001

evaluated in 622 ears (10 patients had preoperative anacusis and 4 were mentally deficient). At the last follow-up the airbone gap was significantly better (X^2-test) (Table II) in 524 ears with only one operation than in 98 ears with revision surgery. The revision rate was slightly higher in ears with severe pathology, such as absent stapes (Table III) and in which a columella had been used. Reoperation was usually indicated for hearing improvement. Among ears with a type IV tympanoplasty, revision was done in only 5 per cent.

Revision was performed in 9 per cent of 224 ears with attic cholesteatoma and perforation (retraction) of the Shrapnell's membrane, and in 18 per cent of 236 ears with sinus cholesteatoma and a posterior perforation of pars tensa and in which the cholesteatoma extended to the tympanic sinus; this is significantly more frequent than in ears with attic cholesteatoma (X^2 test, $p<0.02$). The revision rate was likewise high, 22 per cent, among 162 ears with tensa retraction cholesteatoma.

TABLE III

NUMBER AND PERCENTAGE OF EARS PRIMARILY OPERATED UPON FROM JANUARY 1965 TO DECEMBER 1978 FOR ACQUIRED CHOLESTEATOMA AND REVISED DURING THE OBSERVATION PERIOD FROM JANUARY 1965 TO FEBRUARY 1981 BY US OR ELSEWHERE.

Ossicular Pathology	Total Material	No	%
Intact chain	111	16	14.4
Stapes present—interposition	314	49	15.6
Stapes present—myringo-stapediopexy	18	1	5.6
Stapes absent—columella	157	31	19.7
Stapes absent—type IV	22	1	4.5
Total	622	98	15.8

The operation consisted of canal-down mastoidectomy with obliteration in 216 ears, a modified canal-up mastoidectomy in 285 ears (Tos, 1982a), and tympanoplasty without mastoidectomy in 121 ears. The hearing results obtained with the various methods have been published elsewhere (Tos, 1982b). The indication for revision was residual cholesteatoma in 44 ears (7 per cent), whereas in the remaining 54 ears the indication was lack of improvement in hearing, reperforation of the eardrum or discharge from the cavity.

During the same period, revision was performed in 14 per cent of 133 ears with canal-up mastoidectomy. Of these, 3 per cent had intact ossicular chain, 14 per cent had stapes present and 35 per cent stapes absent. Among 91 ears with canal-down mastoidectomy, reoperation was performed in 7 per cent, viz. 6 per cent with stapes present and 12 per cent with stapes absent. The indications for reoperation in both groups are shown in Table IV. The higher revision rate with the canal-up technique does not imply that this technique is

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TABLE IV

CAUSES OF REVISION IN 25 EARS PRIMARILY OPERATED UPON FOR ATTIC CHOLESTEATOMA WITH CANAL UP AND CANAL DOWN TECHNIQUE.

Condition	Canal up No=133	Canal down No=91	Total No=224
Recurrence	7	2*	9
Ossiculoplasty	6*	1	7
Reperforation	3	—	3
Discharge	2*	3	5
Retraction	2*	—	1
Total	19 (14%)	6 (7%)	25 (11%)

* Revision was in one ear, in total four ears performed elsewhere.

inferior to the canal-down technique (Tos, 1982a).

A comparison of the revision rate in the 636 ears with cholesteatoma (15.4 per cent), primarily operated upon before the end of 1978, and in the 740 ears with cholesteatoma that had surgery before the end of 1980, as analysed by the end of 1982 (Table I), shows that the total revision rate (15.6 per cent) did not increase with the additional 2 years of follow-up.

The percentage of previous surgery, i.e. procedures prior to the first operation in our department, is not very high (3 per cent) among ears with cholesteatoma, which is due to the fact that only those with a primary operation for this disease are included in the series. The total revision rate thus amounts to about 19 per cent (15.6 per cent+3 per cent).

Chronic granulating otitis

Chronic granulating otitis denotes non-cholesteatomatous ears with chronic discharge that are not made dry by preoperative treatment and in which the purpose of operation is to obtain a dry ear. During the period from January 1965 to December 1980, 229 ears received surgical treatment. Our primary operation consisted of canal-down mastoidectomy with obliteration in 90 ears; canal-up mastoidectomy in 86 ears; and tympanoplasty without mastoidectomy in 53 ears. These ears were seen at follow-up several times over the years, lastly in the autumn of 1984. Re-examination included 83 per cent of the ears, with a mean follow-up of 9.5 years (range 2.5–19.75 years). Of the 38 patients who did not attend the follow-up examination, 11 did not respond to our invitations, 3 could not be traced, 2 were ill at the time of examination, 8 died of other causes, 12 had moved to other parts of the country and 2 were abroad. The primary hearing results (0.6–2 years post-operatively) in these patients did not differ from the results obtained in those attending the follow-up examinations.

Revision surgery: The analysis made by the end of 1982 showed a revision rate of 12.2 per cent (Table I). By the end of 1984, 14 per cent had been reoperated upon once, 1.7 per cent twice and 0.4 per cent three times. The total revision rate had thus risen to 16.1 per cent (Table V). This increase is mainly due to a thorough registration of revisions elsewhere.

Half of the revisions were performed within the first five years (Fig. 2). From 10 to 15 years after the first operation, only a few ears had revision and some had a second reoperation. The indications included eardrum perforation

TABLE V

CHRONIC GRANULATING OTITIS. 229 EARS OPERATED UPON FROM JANUARY 1965–DECEMBER 1982. REVISION RATE AT TWO EVALUATIONS

Evaluation	Revisions (ears %) One	Two	Three	Total No.	Total %	Total operations No.	Total operations %
December 1982	12.2	—	—	28	12.2	28	12.2
Sept.–Dec. 1984							
Reopr. by us	12.7	0.8	—	31	13.5	33	14.4
Reopr. elsewhere	1.3	0.9	0.4	6	2.6	10	4.4
Total	14.0	1.7	0.4	37	16.1	43	18.8

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TABLE VI

CHRONIC GRANULATING OTITIS. HEARING AFTER ONE OPERATION AND AFTER REVISIONS

Air-bone gap	One operation		Revised ears	
	Preopr. No=192 %	Last eval. No=154 %	Preopr. No=37 %	Last eval. No=37 %
0–10 dB	4	36	0	11
0–20 dB	15	66	0	57
0–30 dB	46	82	11	59
		p<0.05		
Absolute hearing				
0–20 dB	0	27	0	14
0–30 dB	14	44	3	35
		p<0.05		

and periodic discharge in 30 cases (13.1 per cent) and deterioration of hearing in 7 cases (3 per cent). Reperforations were in most cases closed at the reoperation. The hearing results in these 37 ears, as assessed by several methods, were significantly poorer (X^2 test) both primarily (0.5–2 years) and later (2.5–19.75 years) compared with the results achieved in 192 ears which had only one operation (Table VI).

Previous surgery: 42 ears (18.3 per cent) had received surgical treatment in other hospitals prior to our first operation; the most frequent procedure was simple mastoidectomy in childhood (Table VII). The hearing results in these ears were comparable, both primarily after the operation as well as at the latest follow-up, to those found in 187 ears that had their first operation in our department (Table VIII).

The total number of ears that had two or more operations include the 42 ears with previous surgery and the 37 ears that had revisions after our first operation. Nine ears with previous surgery also had a revision after our first operation, so that the total incidence of two or more reoperations amounted to 30.6 per cent (70 ears).

Other diseases

Sequelae to chronic otitis, denoting dry ears with eardrum perforation and in many cases ossicular defects, show a relatively low revision rate (Table I). The lowest rate occurred in ears with adhesive otitis, which is attributable to the fact that we have been reluctant to reoperate upon ears with repeat retractions and adhesion of the eardrum.

Reconstruction of old radical cavities accounts for a relatively high percentage of the revision procedures (Table I). All of these ears have, by definition, had at least one previous operation elsewhere. The percentage of previous surgery is 100 and the percentage of ears with two or more preceding operations elsewhere is about 30. This group shows by far the largest number of interventions per ear.

Discussion

It is not the purpose here to compare our revision rate with that of other surgeons since the differences would reflect the attitude

TABLE VII

CHRONIC GRANULATING OTITIS. PREVIOUS SURGERY ELSEWHERE

27	simple mastoidectomy
1	simple mastoidectomy, later tympanoplasty
6	attico-antrostomy
7	tympanoplasty–myringoplasty
1	tympanoplasty three times
42 ears (18.3%) 45 operations	

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TABLE VIII
CHRONIC GRANULATING OTITIS. HEARING IN EARS WITH PREVIOUS SURGERY

Air-bone gap	No previous surgery		Previous surgery	
	Preopr. No=187 %	Last eval. No=156 %	Preopr. No=42 %	Last eval. No=35 %
0–10 dB	3	31	5	31
0–20 dB	12	62	17	60
0–30 dB	41	79	40	71
		n.s.		
Absolute hearing				
0–20 dB	5	26	5	20
0–30 dB	12	45	12	31
		n.s.		

towards revision rather than the surgical methods themselves. On the other hand, it is important to discuss the rate of revisions with the objective of finding some generally acceptable definitions of the various types of reoperations. In this study, we denote as 'previous surgery' all operations performed elsewhere prior to our first operation, and all ensuing procedures are denoted 'revisions', regardless of where they were performed. Although protests can be raised against such a simple division, it does afford the possibility of calculating a realistic reoperation rate and of analysing the end-results. It appears, otherwise, quite impossible to make any kind of realistic comparison of what is called 'revision surgery' by individual surgeons. The actual revision rate may be obscured by the fact that the various diseases and their sequelae as well as the surgical procedures employed often change greatly during the observation period (Fig. 1), and that ensuing operations are regarded as either new procedures or as operations for new pathologic conditions (e.g. reconstruction of a radical cavity).

In spite of the fact that half of the revisions took place within the first 5 years after the first operation (Fig. 2), a long follow-up period is essential for obtaining a realistic view of the revision rate in different diseases. A thorough re-examination combined with a long observation period and a large attendance at follow-up will result in an increase in the revision rate because procedures performed elsewhere will be recorded (Table V).

The functional results are poorer in the reoperated ears than in ears operated once only (Tables II and IV), although the hearing in the revised ears did show great improvements compared with the pre-operative hearing.

The indications for revision varied (Table IV) and it is difficult to lay down general rules determining to what extent small reperforations should be closed or hearing-improving surgery attempted. It is, in fact, easier to indicate the cases in which revision should *not* be done. Thus, the poorest results of revision occurred in ears with small perforations, small air-bone gaps, poor tubal function, and adhesions.

In chronic granulating otitis, 31 per cent of the ears had had two or more operations, although we have been reluctant to reoperate upon these ears. However, the majority of ears had had previous surgery elsewhere.

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