REMARKS
ON
TWO FORMS OF ATROPHY
OF
THE HEART'S VALVES,
WHICH
INTERFERE WITH THEIR FUNCTION:
FOUNDED ON A SERIES OF CASES.

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I OBSERVED nearly five years ago that the heart's mitral and tricuspid valves were subject to a lesion not hitherto described by authors. Having since met with numerous cases, in eight of which its peculiarities were strongly marked, and its extent considerable, I now venture to submit to the Society a few remarks on its history.

I. *Anatomical Characters.*

The lesion may be defined a simple shortening of the heart's mitral or tricuspid valve, without any diminution of its natural thinness, pliancy and transparency: the orifice to which it belongs possessing at

least the ordinary calibre. In other words, it is an atrophy of the valve in the direction of its length. The extent to which the valve is thus wasted is often considerable. Thus, the length of the posterior lamina of the mitral valve, which is naturally from seven to nine lines, was in one case reduced to three lines: in another it no where exceeded a line and a half, and was for the most part only a line. The laminæ of the tricuspid valve are naturally from eight to eleven lines in length: but in one of my cases they all three fell very far short of this, and one was only three lines. The valves in question are generally thinner than is natural: but as attenuation does not interfere with the fulfilment of their function, it does not of itself constitute disease.

There is another lesion to which all the heart's valves are subject, so nearly allied in its nature and effects to the foregoing that I shall consider it at the same time. The continuity of a valve so affected is interrupted by apertures, sometimes of large size, and sometimes so numerous as to reduce the structure to a mere net-work, while the remainder is in a state of attenuation which is here and there often extreme, especially towards the edges of the apertures. Sometimes a large gap is seen, subdivided only by a few thready fibres. These in the case of the auriculo-ventricular valves, are generally prolongations from chordæ tendinæ. In at least four of the cases which have occurred to me since I first observed it three years ago, the lesion had gone to a sufficient extent to have materially interfered with the valve's function.

Dr. Davis of Dublin, to whom, while in London last August, I communicated these researches, has lately favoured me with a very interesting case of this form of atrophy, which I shall consider as one of my data through the remainder of the essay.

This cribriform character of the valve, as connected with attenuation, I had long believed to be also unnoticed by any author; but sometime after the composition of this paper I met with the following observations by Laennec. “Les valvules peuvent aussi présenter des vices de conformation, moins importants, il est vrai, mais qui ne laissent pas que d'être graves. On rencontre quelquefois de petites ouvertures à bords lisses et oblongues sur les diverses valvules du cœur. J'en ai vu sur la valvule tricuspidale qui par leur rapprochement présentaient un réseau très étendu.”* This is the only allusion made by any author to the affection, in as far as the pulmonary and auriculo-ventricular valves are concerned. But while correcting this paper for the press I have been referred to a valuable paper by Dr. Corrigan, in the *Edinburgh Medical and Surgical Journal* for 1832, in which the cribriform condition of the *aortic* valves is thus described: “The valves may be absorbed in patches, and thus become reticulated, and present holes through which the blood flows back into the ventricle.”

It now and then happens that valves which have become thickened and indurated in various ways are shortened or cribriform. In a case cited by Burns, on the

* *Traité de l'Auscultation*, Tome II. p. 549.

authority of a friend, it is said, "The mitral valve was indurated and reticulated." Illustrative of the shrinking which may attend inflammatory thickening, was a case I met with in 1831. The patient, who was a waiter at an inn, aged 27, had during the last four years of life had several attacks of acute articular rheumatism. These were always attended with violent precordial pain and palpitations, which abated but did not subside in the intervals of the attacks. For four or five weeks before death there were cough and dyspnœa, anasarca, and ascites.—The posterior lamina of the mitral valve was yellow, opaque, much shortened, and the sixth of an inch in thickness. The adjacent portion of the inner membrane of the left auricle, for the extent of about two inches, was much thickened and corrugated, opaque, and of nearly the same hue as the valve. The whole heart was dilated and hypertrophous: the left auricle had twice the capacity of the right. The pericardium contained about a pint of yellowish serum: it was otherwise healthy. The pleuræ and peritonæum likewise contained a good deal of serum. The lungs and liver were congested.

In Bouillaud's recent work * it is remarked, "The cartilaginous, ossified, and petrified valves undergo changes of conformation the most different. In some cases their laminæ are turned in and rolled upon themselves, and then represent a sort of narrow ribbon; they are too short and too rigid to be able to close the orifice at which they are placed." But neither

* *Traité Clin. des Maladies du Cœur*, 1835.

Bouillaud nor any other writer has noticed that, while shortening is sometimes an accident of the various kinds of thickening and induration to which the valves are subject, it not unfrequently exists as a separate lesion, constituting the only deviation from the natural condition.

II. *Comparative frequency.*

That these are far from being rare lesions in comparison with the others to which the heart's valves are subject, may be inferred from the circumstance that out of about thirty fatal cases of diseased valves of which I took notes during a definite period, one or other of these species of atrophy existed in ten. The mitral valve was shortened in five, the tricuspid in five, both in two. In one the mitral valve was cribriform, in two the tricuspid, and in one both the aortic and pulmonary valves were so.

How then, it may be asked, has it happened that, notwithstanding the heart's lesions have excited more interest than those of almost any other organ, these should so long have escaped notice? The oversight may be partly accounted for on the ground that the lesions in question are above all others likely to elude observation, until the attention has once been directed to them. If the valves are in a cartilaginous or osseous condition, or occupied by vegetations, the change is such as immediately to strike both the eye and the touch. But if they are lying down against the side of the ventricle or artery without any deviation from the natural appearance except a diminished

extent of surface, their defect, though obvious when pointed out, is of a kind easily to pass unnoticed. It is indeed often necessary, before the length or integrity of surface can be accurately ascertained, to cut the chordæ tendinæ and lift up the valve under examination.

III. *Functional effects, and diagnostic signs.*

A valve which has become shortened or cribriform is of course incompetent to close completely the orifice to which it belongs: and hence permits that regurgitation which it was placed to prevent.* This insufficiency of the valve forms a counterpart to the lesion already well known, in which, while the valve remains unchanged, the orifice becomes dilated. Its effect must obviously be to weaken the force with which the blood is propelled through the arterial system, and to favour its accumulation posteriorly to the affected valve. This effect will be in a great measure proportioned to the extent of the valvular deficiency and to the size of the corresponding orifice. When dependent on shortening, it will also be liable to increase from bodily exertion: for it was shewn by Mr. Hunter† that the heart at its diastole dilates much more while the body is in activity than while at rest; and it is evident that when an orifice has become un-

* It is generally admitted that the valves, in the natural state, are but just large enough for their office; and Mr. Hunter had "reason to believe that the valves in the right side of the heart do not so perfectly do their duty as those of the left."

† On the Blood, &c.

usually dilated at the diastole, its valves, if shortened, will at the succeeding systole be still less able to meet than they were before. Mental emotions and other circumstances by which the heart's action is stimulated, will promote the operation of this lesion in the same way.

From this disablement of the valve will hence arise a strong tendency to dilatation or hypertrophy of those parts of the heart posterior to the valve affected; to palpitation, venous congestions, anasarca and effusion into the serous cavities; and where the mitral or aortic valves are defective, to dyspnœa and cough, to pulmonary congestion and inflammation, and to some of those symptoms which are apt to arise from deficient and irregular supply of arterial blood to the head and remote parts of the body. At the same time it may be presumed that the degree of tendency to the production of these affections, is less than that of those diseases of the valves which not only permit regurgitation, but likewise by narrowing the orifice obstruct the passage of the blood in the natural direction.

These two species of atrophy sometimes co-exist or are combined with other defects of the valve or its orifice: and then, though each be slight, their united influence may be considerable. Thus, in some of my cases the orifice was dilated in one, the posterior lamina of the mitral valve was both shortened and cribriform, and the anterior lamina was indurated: in a case where the tricuspid valve was affected, one lamina was cribriform, while the other two were con-

nected at their apices by a transverse band having all the appearance of healthy valvular structure.

Thus far we can confidently advance by the aid of established principles in physiology and pathology. And it is fortunate that we can do so; for as these diseases are most frequently found combined with other impediments to the circulation, it would by cases alone be difficult to prove in a decisive manner how much of the symptoms appertained to each. As it is, no more is required than to shew that the cases observed are not in contradiction with the conclusions thus clearly pointed out by physiological and pathological principles.

In all the cases in which the circumstances are fully detailed, there had been anasarca and palpitations; and in all but one, dilatation of some cavity posterior to the affected valve. In all in which the valves of the left side were defective, there had been dyspnœa and cough, pulmonary congestion and inflammations: the radial pulse and the precordial impulse were frequently irregular and unequal; and out of the only four of these cases in which the history is sufficiently known, one patient was very subject to attacks of faintness and debility, another to vertigo and epileptic fits, a third died in a fit of syncope, and the fourth, after total sleeplessness for a fortnight, sunk into a state of coma which was fatal in a few hours. Where the defect lay in the mitral valve, the pulse at the wrist, compared with the beat at the heart, was generally small and weak; and where in

the tricuspid, there was distention, sometimes attended with pulsation of the external jugular veins ; in those cases, at least, in which they were examined. In several, the symptoms could not have been fully accounted for, had these valvular lesions been overlooked.

Further experience is required to shew with precision by what modifications of the heart's sounds these defects are characterized. But I am satisfied from the stethoscopic examinations which I made, and from many analogous instances of simple regurgitation *, that a bellows sound is often produced during the reflux of the blood through the affected valve.

By a reference to these symptoms, and to the circumstances out of which the complaint arose, it may generally be ascertained during life whether or not there is valvular disease. The discrimination of these from

* The only other lesions which modify the heart's sounds by simply permitting regurgitation, are dilatation of one of the heart's orifices, adhesion of a valve to the adjacent surface, and, as was first noticed by Dr. Hope, "contraction of the chordæ tendineæ." It is strange that M. Bouillaud, in 1835, should affirm, "Je n'ai observé que cinq ou six fois l'adhérence des valvules auriculo-ventriculaires aux parois du cœur, lésion qui n'avait encore été signalée par aucun des auteurs, qui ont traité des maladies du cœur *ex professo*:" when Dr. Elliotson, five years before, in one of the most distinguished works that have appeared on the diseases of the heart, had given three cases from his own experience, and one from another author, in which a part of the tricuspid valve was "bound down," and in explaining one of the plates, had observed that "one half of the tricuspid valve was completely adherent to the ventricle."

the other lesions of the valves is a point of great nicety, on which I am not yet fully prepared to speak *.

IV. *Mode of Production and Causes.*

It is possible that these defects may now and then be congenital. But there is no evidence whatever to shew that they ever are so ; and there are the strongest reasons for believing that in the great majority of cases they occur at periods subsequent to birth.

I shall hereafter shew that they are in their nature closely analogous to other lesions which take place after birth ; and that in all the cases causes had occurred, which are known to produce in other parts of the body effects of the same kind. In four out of the five cases in which the valves were cribriform, and in six out of the eight cases in which they were shortened, the patient had reached middle or advanced life, before the symptoms of obstructed circulation manifested themselves ; though they had most of them followed laborious occupations, as those of cook, sailor, and carpenter, and several had been given to excess in spirituous liquors. Could this

* I cannot agree with Dr. Corrigan in considering visible pulsation of the arteries of the upper part of the body as pathognomonic of permanent patency of the aortic orifice : for in several instances in which after death I found the aortic orifice permanently patent, these arteries had exhibited no visible pulsation ; while in some of the most striking instances I have met with of this visible pulsation, the aortic orifice was free from defect of every kind, and in others, the defect was such as to produce much obstruction, but little or no regurgitation.

have been the case in so many instances, had the heart's valves been from birth materially defective?

By what mode of action then, was the size of the valves thus curtailed; by ulceration, by simple progressive absorption without suppuration, or by interstitial absorption?

The supposition of ulceration would be highly improbable. Ulceration of the heart's valves must be extremely rare, as notwithstanding the numerous opportunities which have occurred of examining them at all stages of their inflammations, and notwithstanding the eagerness with which proofs of inflammatory action have been looked for, there is but one decided case of their ulceration on record, and in that it had not proceeded to perforation. The case is given by Bouillaud as one of ulceration, but without any detail of the marks by which the breach of texture was characterized. In the cases at present under examination the valves presented appearances exactly opposite to those which attend ulceration: they were thinner, more pliant, and more transparent than natural, and the attenuation gradually increased towards the edges of the perforations.

These appearances are on the other hand most characteristic of those species of absorption unattended with suppuration; and I shall presently shew that in all the cases, some of the commonest and most efficient causes of these actions had been applied.

Of these two species of absorption the apertures can of course be ascribed only to the progressive;

and in two cases at least in which the valves were both shortened and cribriform, the shortening was most likely produced by the same process as the apertures, by a progressive absorption of a portion of the valve at its free edge.

The remote causes of these lesions remain to be investigated.

In nine out of the ten instances in which the mitral or tricuspid valve was shortened, there was hypertrophy of the corresponding ventricle, which is in general preceded as well as attended by an increased force of the heart's contraction. In several, there was likewise obstruction to the discharge of the blood from the hypertrophous ventricle. In most, the patients had followed laborious occupations; and two traced their complaints in a great measure to over-exertion.

In these nine instances, therefore, the blood's impulse against the valve affected had been permanently increased, and the valve had hence been subjected to an unnatural degree of pressure, an agent very frequently observed to occasion the atrophy of almost every tissue and organ in the body. The absorption of the sides of the vertebræ from undue inclination of the superjacent portion of the spine; of the spinal cord from the encroachment of displaced vertebræ; of the renal structure from the pressure of neighbouring tumours; of the hepatic structure from the pressure of tumours or distorted ribs; of the cellular substance from the progress of abscesses and encysted tumours towards the surface, afford familiar illustra-

tions. Professor Thomson, of Edinburgh, saw "a case of ascites abdominalis in which the integuments had become so thin, that after the water was drawn off by a trocar, the peristaltic motion of the intestines could be distinctly seen through them:" and has "seen similar absorptions of the cellular substance in cases of femoral, scrotal, and umbilical herniæ."* Cruveilhier remarks that "Atrophy of the lymphatic glands soon succeeds their hypertrophy, when the effused juices come to exert a considerable pressure on their glandular structure."† Portal, Laennec, and Bouillaud have met with cases in which the muscular substance of the heart has become atrophized by the pressure of pericardiac effusion. It is well known, with how much success the influence of pressure is frequently resorted to in medicine and surgery for the removal of morbid growths and fluid accumulations.

I may add the following illustrations of the absorption of serous and fibro-serous membranes under the influence of pressure. When ossific deposit takes place under the inner membrane of the heart or arteries, that membrane, at first entire, gradually becomes absorbed at the parts where the pressure of the deposit is most considerable.—A case is related by Mr. Hunter in which a tumour formed in the pia mater or brain, "had, by pressing against the dura mater, produced the absorbing disposition in that membrane, so that this membrane was entirely gone at that part. The same irritation from pressure had

* Lectures on Inflammation.

† Dict. de Medecine et de Chirurgie. Art. Hypertrophie.

been given to the skull, which also was absorbed at this part; after which the same disposition was continued on to the scalp. No matter was to be observed here from either the dura mater, the unconnected edges of the bones of the skull, nor from that part of the scalp which had given way."*—A case occurred some years ago at St. George's Hospital, in which a number of little tumefactions of the surface of the brain had by their pressure caused a complete removal of the portions of dura mater above them, and had formed for themselves little receptacles in the skull. Here again there was no appearance of suppuration.—In an old woman who had for some years before death been obliged to work beyond her strength, and been subject to violent palpitations, I found the heart generally hypertrophous, and the left side of the pericardium in a state of extreme attenuation, with here and there a deposition of fat externally to it. In one place where it was adherent to the left lung, the pericardium with the two pleuritic laminæ did not altogether exceed the thickness natural to a single lamina of pleura. In this case I conceive the extreme attenuation of the pericardium to have been partly owing to the friction of the hypertrophous and over-exerted heart.

From these and other instances of the influence of pressure it might have been expected that the blood's impulse, when preternaturally increased, would in some cases have the effect of atrophizing the valves. That the blood may sometimes act on the parts

* On the Blood, Inflammation, &c.

against which it is propelled as continuous pressure acts upon other parts, is shewn by the absorption of the diseased coats of arteries from merely the ordinary pressure of the moving blood, as remarked by Mr. Hunter; and by the total or partial absorption of the venous valves, when strained, as proved by Meckel*.

There can, therefore, be no doubt that in the cases at present under consideration, the undue force of the blood's impulse against the valves may have been powerfully instrumental in promoting their atrophy. It could not, however, have been singly sufficient: for in some cases it has not at all impeded their nutrition, and in others it has been followed by an opposite change to that now considered. Dr. Hope and M. Cruveilhier assign it as one of the causes of the cartilaginous and osseous degenerations of the valves. I have further observed that in many such cases, the valves, without undergoing any change of structure, have simply acquired a moderate augmentation of thickness, by which they have been enabled to meet the increased demand upon their strength.

The undue force of the blood's impulse, therefore, in order to atrophize the valve, must have been assisted by some other cause. In the nine cases at present under review the only cause that can be supposed is a debility of the valve's nutritive powers, in consequence of which its nutrition was obstructed by a degree of pressure which, had these been vigorous, they would have been able to withstand.

* Anatomie Générale.

This kind of local debility has been remarked in other organs and tissues of the body ; having been in many instances seen to depend on chronic disease of the part, or on other circumstances diminishing its supply of arterial blood, while in some its origin has not been apparent. In five out of the nine cases, marks of chronic disease were exhibited either by the pericardium, by some of the other valves, or by the inner membrane of the heart or aorta. In these five the valvular atrophy was probably consecutive on disease, with which the valve had been affected at the same time.

To account for the valvular hypertrophy sometimes induced by increased pressure, it is necessary to call to mind that resistance to the blood's natural impulse is what constitutes the essential office of the valves, being to them what walking and running are to the muscles of the lower extremities ; and that, therefore, an increase in the force of this impulse forms an augmentation of the duties of their function. Now it is a well established law of the animal economy, that increased exertion of a part in the discharge of its function has a tendency to stimulate its nutrition and occasion its enlargement. When, therefore, the nutritive powers of the valves are so vigorous as not to be embarrassed by the increased pressure, they will be stimulated to unwonted activity by the additional onus which the valves have to sustain.

From a similar difference of nutritive energy it is, that when obstructions occur to the discharge of the blood from the heart's cavities, its parietes in some in-

stances become hypertrophous, while in others they undergo a passive dilatation without any acquisition of muscular substance to render them equal to the increased exertion required of them. Indeed, in some cases in which the right ventricular cavity had become dilated from impediment to the pulmonary circulation, I have found the muscular substance absolutely diminished; and in a recent case of this kind, the parietes of the right ventricle consisted principally of a thick layer of fat, with a lamina of muscle which in some places did not exceed the thickness of a shilling.

To the causes here assigned for the simple hypertrophy and atrophy of the valves, may be traced several cases I have observed in which these states were combined; in which, the contractile force of the ventricle being increased, the auriculo-ventricular valve has been thickened at its tendinous zone and at the insertions of the principal chordæ tendineæ; while the remainder of the valve, being more scantily supplied with vessels, has for the most part become extremely attenuated, and in some places been entirely absorbed away.

We now proceed to the causes of the cribriform atrophy. Of this there were five cases, in one of which the pulmonary and aortic valves were both affected: in two the auriculo-ventricular valve was shortened as well as cribriform.

One of these patients had been very subject to gout and to precordial palpitations; and two had had several attacks of acute articular rheumatism, attended with well-marked symptoms of inflammation

of the heart ; and after death exhibited old adhesions of the pericardium, and disease of some of the valves similar to that which is known to be consequent on rheumatic affection of the valves.

Are gouty and rheumatic actions capable of so impairing the nutritive powers of a part in particular constitutions, as to render it liable to be absorbed under the degree of pressure to which it is naturally subjected? In proof that they are, I may cite the following passages from Sir Benjamin Brodie's work on the joints :—" The effects of gout on the joints are very remarkable. The cartilages are absorbed." Again, " The peculiar kind of absorption of the cartilages which is described in pages 311 and 312, as one of the effects of gout, occurs also in some of those cases of chronic rheumatic inflammation, which are often distinguished by the appellation of rheumatic gout. The process by means of which this absorption is effected is manifestly different from ulceration."

That rheumatic action, while it in some cases thickens the valves, may in others render them liable to be partially absorbed from the blood's friction, is confirmed by the following case, which I have not previously alluded to. A man, who died at the age of forty-two, had from boyhood been subject to acute attacks of articular rheumatism, which during the last five years were attended with severe heart symptoms. The mitral orifice was extremely contracted from cartilaginous and osseous degeneration. The aortic valves adhered to one another, and were for the most part thickened: but they presented several

large apertures, around which their structure was much attenuated.

In two of these three cases, the heart's muscular substance presented a singularly pale, friable, flabby condition, unequivocally proving extreme languor of nutrition : and in one of the two, there was a deposition of fat by the side of the cribriform valve, strengthening the analogy between this atrophy and the atrophies of other organs depending on failure of nutrition.

In the remaining two of the five cases, the cribriform atrophy was referable to the causes which have been assigned for the shortening ; namely, to an undue force of the blood's impulse, combined with debility of the valves' nutritive powers from previous disease. The first circumstance was proved in both by hypertrophy of the corresponding ventricle, and obstruction to the discharge of its blood : the second was in both rendered probable by marks of chronic disease of the heart's valves in other places.

In considering this cribriform atrophy as the result of disease after birth, and as sometimes referable in part to increased pressure, I am happy to find myself confirmed by the explanation which Meckel has given of the same defect when occurring in the valves of the veins.

From the foregoing observations it may be inferred that these forms of atrophy of the heart's valves are most frequently owing either to local debility connected with undue force of the blood's impulse, or altogether to a degree of local debility (often conse-

quent on gouty or rheumatic action) so great as to render the valves liable to be absorbed under the degree of pressure to which they are naturally subject.

V. Prevention and Treatment, and other practical bearings.

1. When there have been post-mortem examinations of cases in which this lesion existed, but in which it passed unobserved, the symptoms to which it had given rise during life have necessarily been referred to some other cause. Thus, if this lesion had communicated to the ear of the stethoscopist a morbid murmur, the case has been considered as affording an instance of morbid murmur independent of valvular disease. Whenever it has occasioned, or helped to occasion palpitations, syncope, dyspnoea, dilatation of the heart's cavities, or dropsy, some concomitant or hypothetical lesion must have unjustly borne the blame. Hence have been deduced erroneous conclusions respecting the nature of diseases, and the diagnostic import and value of symptoms; which a knowledge of these lesions will rectify.

2. From what has been said of their causes, we may expect to diminish the frequency and severity of these lesions by avoiding those circumstances which are known to encourage inordinate action of the heart, and by studying to prevent the metastasis of gout and rheumatism of the heart, and to improve its treatment when it occurs.

3. To distinguish during life these lesions from those which are attended or supposed to be attended

with chronic inflammation of the valves, is desirable, as bearing immediately on the treatment of both: since some of the means advantageously resorted to for subduing inflammatory action, and inducing absorption of inflammatory depositions, are not always proper in cases of atrophy where no inflammatory action or deposition exists.

4. But the diagnosis of these lesions, even so far as to know that there is *some* valvular defect obstructing the circulation, will be highly advantageous to the patient.

If the lesion be undetected, the symptoms will be supposed to indicate some other disease, as hysteria or dyspepsia: and hence a wrong opinion will be pronounced in regard to the future progress and the termination of the case; and, what is more material, the appropriate remedies will be neglected, while others, calculated perhaps to injure the constitution and increase the real disease, will be exhibited.

It is generally agreed that, in valvular disease, the more distressing and fatal symptoms with which it is often attended, do not occur until the supervention of hypertrophy and dilatation. By a judicious employment of remedies, and regulation of the patient's habits, these consequences may often be warded off for a long term of years. The means adapted to this end need not for the most part be specified, as they are identical with the palliative treatment of the other purely mechanical valvular lesions. But I may remark, that while great muscular exertion is of all things the most injurious, a good deal of very gentle

exercise, by determining the blood to the remote parts, and relieving the heart and great vessels of their distension, is in many cases highly beneficial.

5. It might at first be thought certain that, however the symptoms may be alleviated, the lesion itself is incapable of removal or even of diminution. But it is not unlikely, that if the heart's action can be kept tranquil, and the quantity of circulating fluid be reduced, the orifice and cavities to which the defective valve belongs, may gradually diminish in calibre, so as to become adapted to the altered size of the valve.

I have met with cases in which, one of the heart's orifices being dilated, its valve has enlarged in a proportionable degree. From this fact, and from what is known of the renovating powers of nature, a hope may be derived, that where we can remove the causes by which the valve was originally atrophized, its structure may sometimes be restored to its original dimensions.