FUNCTIONAL PROBLEMS CONNECTED WITH BILATERAL RADICAL NECK DISSECTION*

By ETTORE BOCCA† (Milan)

ONE of the most disquieting aspects of the surgery of cancer of the larynx is the early or distant appearance of lymph node metastases. Recent statistics demonstrate that about 30 per cent. of the laryngectomized patients die sooner or later from metastastic invasion of the lymph node chains of the neck.

The problem of the prophylactic and therapeutic treatment of the cervical metastases of the laryngeal cancer is an old one. Gluck and Sorensen first stated that the lymph nodes of the neck should be removed whenever a laryngectomy is performed for cancer.

The necessity of a radical neck dissection whenever clinical metastases are present is to-day unanimously recognized, provided that it is still surgically possible.

On the contrary, opinions are very much divided as to the necessity of systematically performing a neck dissection whenever the laryngeal cancer is so situated as to make it highly probable that it will spread or that it has already spread to the lymph nodes in the neck.

A careful clinical and histological investigation of the cervical lymph nodes in about 500 patients with cancer of the larynx operated at the Otolaryngological Clinic of Milan for therapeutic or prophylactic neck dissection, has revealed that the occurrence of metastases is the following:

Supraglottic cancer	marginal	73%
	vestibular	50%
	ventricular	30%
Cancer of the vocal cords		0·4%
Infraglottic cancer		46%
Cancer of the hypopharynx (primary or secondary to laryngeal cancer)		76%
Diffuse cancerization of the larynx		90%

In more than half the cases the metastases were clinically mute and they were demonstrated histologically. When the histological findings were negative, an aspecific reaction of the lymphatic sinuses was most often encountered, which, in the absence of inflammation, is to be regarded a premonitory sign of a future neoplastic invasion.

In spite of the tremendously high figures reported above, many laryngologists maintain that the glands should be left undisturbed except in the cases in which they are manifestly enlarged: otherwise, X-ray

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therapy should be given to the lateral regions of the neck. Now, we all know by experience that the therapeutic result of radiation on metastatic lesions is generally poor. And we may add that when clinical metastases have set in, even the result of surgery is poor.

Statistics drawn from the material of the Otolaryngological Clinic of Milan show that 5-year cures in surgically treated vestibular cancer of the larynx are the following:

	Five years cure
Cancer with clinical metastases:	
Laryngectomy or pharyngolaryngectomy, radical neck dissection and post-operative irradiation (7000-9000 r)	25%
Cancer without clinical metastases:	
Laryngectomy or pharyngolaryngectomy and post-operative irradiation	33%
Laryngectomy or pharyngolaryngectomy, radical prophylactic neck dissection and post-operative irradiation	65%

These figures are by no means surprising: they are more or less equal to those regarding cancer in general, in areas where a regional surgery is possible.

On the contrary, it is surprising that laryngologists should keep on arguing upon a problem which has long been unanimously settled in other fields of cancer surgery, namely, breast and uterus.

Pietrantoni maintains that each time the cancer is situated outside the vocal cords laryngeal surgery should be systematically a regional surgery, that is to say, it should comprise in an indivisible unit the larynx with its lymphatic tributaries in the neck. It should never wait for metastases to become clinically evident.

In all cases where the situation of the cancer is such as to make a bilateral invasion of the lymph nodes probable, prophylactic neck dissection should extend to both sides as a two-stage procedure. Limiting it to the side of the prevalent spread of the primary growth would be the equivalent of denying the very principles on which the prophylactic surgery of metastases is based. A "partial" dissection on the contralateral side, according to the Silvester-Begnis technique, which respects the internal jugular vein, does not likewise come into discussion.

As Crile says and StClair Thomson reports: "The key to the neck dissection is the excision of the internal jugular vein."

We have no guarantee that lymphatic invasion has not yet started even in the absence of any macroscopic evidence, and the basic principle of cancer surgery, "never cross a cancer field", would be utterly disregarded by a partial dissection.

Let us now examine the common objections made by laryngologists to the neck dissection adopted as a routine surgical procedure:

1. Neck dissection may often prove an unnecessary mutilation. Many of the patients submitted to laryngectomy plus X-ray therapy will never develop metastases. This is true. But, as also Dargent says, it is far better to perform 50 per cent. "white" dissections than to allow the other 50 per

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cent. to develop clinical metastases, the outcome of which, as we have seen, is most often fatal. Moreover, modern operative procedure and the use of antibiotics make block surgery of the larynx together with the laterocervical regions as safe as laryngectomy alone. Neck dissection on the diseased side or on both sides adds nothing to the mutilation unfortunately connected with removal of the larynx.

2. In order to be truly prophylactic, neck dissection should often be performed on both sides; with serious, or maybe fatal circulatory disturbances due to the ligature of both jugular veins; and with severe postoperative impairment of motility of the neck and cervical girdle.

That a bilateral neck dissection can be safely performed as a two-stages procedure has been reported by several surgeons, especially in North and South America. Quite recently the favourable results of one-stage radical bilateral neck dissection have been reported by North American authors. However, these authors refer to cases in which big cervical metastases were evident. In such cases, even major risks connected with the operation were justified by the therapeutic issue. On the other hand, they could be less easily justified in cases submitted to prophylactic dissection. It is therefore natural that we should devote our attention to considering them very carefully.

As we have seen, the possible ill-effects of a bilateral neck dissection are of two orders: motor and circulatory. The most serious motor effects depend on the bilateral interruption of the spinal nerve with its cervical connections. A more or less complete paralysis of both trapezius muscles rapidly ensues; as a consequence the arms can no longer be elevated above the level of the shoulder; this functional impairment may be very troublesome if the patient has to carry out some manual work, and is also a nuisance in everyday life circumstances; pulling on or off one's shirt or jacket becomes an awkward exercise.

But motor effects can be easily avoided by carefully dissecting and preserving the spinal nerve branches to the trapezius, as suggested by Dargent and systematically practised at our Clinic.

Should the dissection extend also to the submaxillary space, a palsy of the inferior branches of the facial nerve is the usual consequence; this, too, may be avoided by a careful dissection of these branches, according to the technique described by Dargent; however, the lower facial palsy is always partial and tends to recover spontaneously in the course of one year. The absence of both sternocleidomastoid muscles never appreciably impairs the movements of the head.

The circulatory effects arising from the interruption of the greater part of the venous channels of the neck cannot be avoided. When both internal jugular veins are resected and both external and anterior jugular veins ligated in the proximity of the head, the main part of the venous flow from the sinuses of the dura mater can take place first through the

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inferior petrosal sinuses and the basilar plexus into the vertebral veins; and secondly, through the parietal, mastoid, and occipital emissaries, into the occipital venous network and the deep cervical veins; however, these veins being tributaries of the vertebral veins before their ending in the innominate vein, nearly the whole venous blood from the brain must flow through the system of the vertebral veins. Some of this blood may leave the skull through the cavernous sinuses and the ophthalmic veins reaching the veins of the face where too, however, as will be seen, the venous outflow is much impaired. Due to the ligature of the thyrolinguofacial trunks, of the anterior and external jugular veins, the main part of the venous blood of the face must flow through the rich anastomoses between frontal facial, superficial temporal, posterior auricular, and occipital veins into the occipital venous network, and thence, once again into the vertebral veins (Fig. 1). Therefore, both the intracranial and extracranial venous circulation must depend to a great extent on the system of the vertebral veins, which have to cope with a mass of blood normally disposed of by three pairs of big veins. There are, in effect, several other possibilities of venous detour, mainly through the untied portion of the external and anterior jugular veins, between the veins of the face and those of the lower part of the neck, namely, the inferior thyroid veins. Sometimes the importance of such vicarious circulation is also objectively demonstrable, as in the cases illustrated in Fig. 2.

What is the effect of such a massive obstacle to the venous circulation of the head?

One hundred and twelve bilateral two-stage neck dissections with an interval of 3-4 weeks have been performed at our Clinic in the last 5 years. All cases had throughout pre-operative clinical examination, often including electroencephalography and ophthalmoscopy, examination of vision, hearing and vestibular function. In only two cases immediate circulatory effects of a major gravity were observed. They were represented by a marked fall of the arterial pressure independent of the loss of blood, which had been duly replaced by transfusion in the course of the intervention, slowing of the pulse rate, slowed respiration, sluggish reflexes and diffuse cutaneous hyposensitivity; partial loss of consciousness, poor vestibular response to caloric stimulation; briefly, by a semicomatous state. The intrathecal pressure was clearly augmented, the fundus oculi showed signs of slight retinal œdema, the venous tension of the eye was sensibly increased, the e.e.g. tracing was "flat" but showed no signs of localized encephalopathy. The face was of a blue-black colour and the œdema was such as to render opening of the eye-lids impossible. (See Figs. 3 and 4.) In spite of the severity of these initial symptoms, no fatality occurred, and after only 12 hours all cerebral symptoms had subsided; the patient had regained his consciousness, pulse rate, blood-pressure, respiration, intrathecal pressure, and fundus oculi had returned

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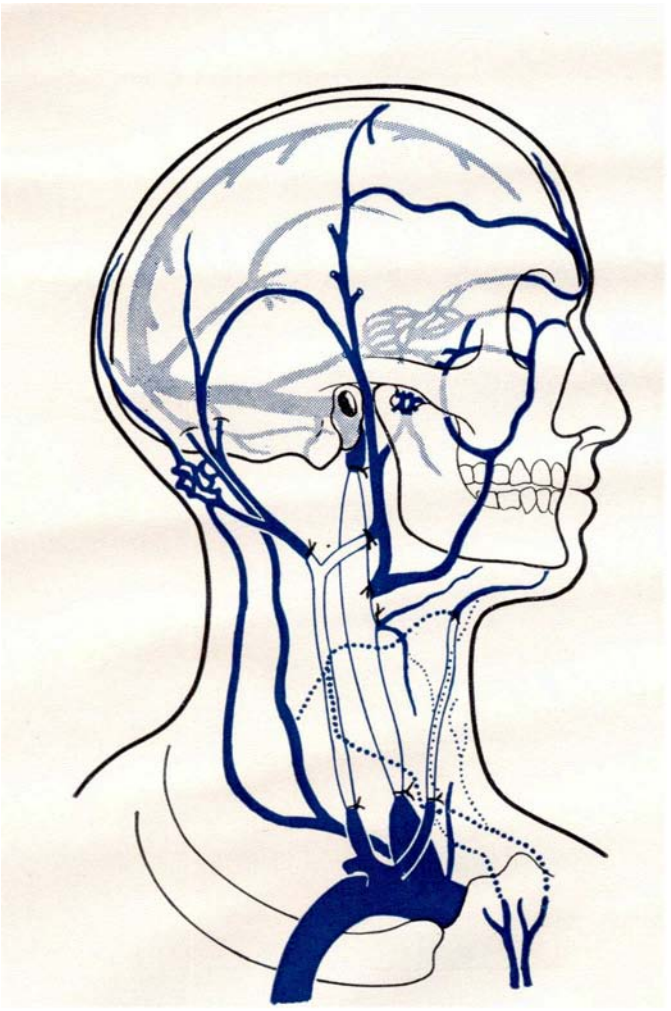


FIG. 1.

Schematic representation of the available channels for venous blood-flow from the head after removal of both internal jugular veins. Full blue: patent channels; (dark blue extracranial circle; light blue: intracranial circle); white: interrupted channels; dotted blue: possibly patent channels through segments of vessels between ligatures.

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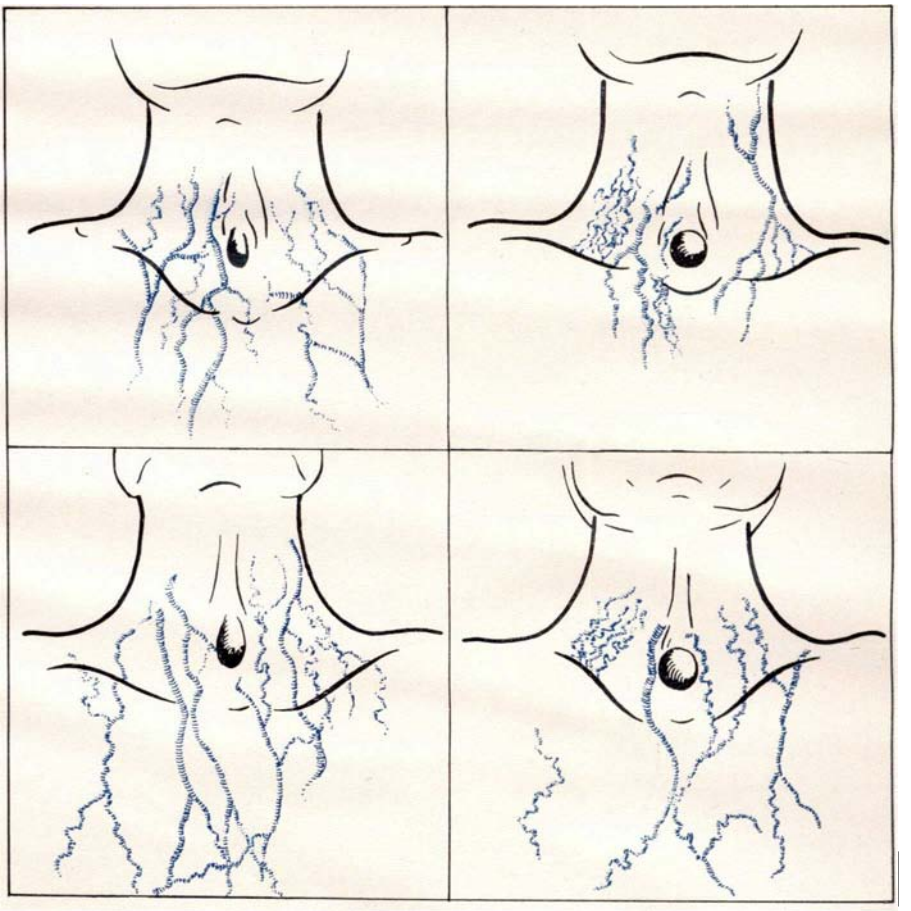


FIG. 2.

Schematic drawing representing four different types of superficial venous anastomosis between the jugular and the subclavian system (inferior thyroid veins and mammary veins). Such anastomoses were observed in about 20 per cent. of patients.

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to normal. However, the cyanosis and œdema of the face persisted practically unchanged for some days following. In all other cases no signs of importance could be observed; consciousness was perfectly normal at all times and no relevant changes of the pulse rate, blood-pressure, cerebrospinal fluid pressure, respiration, or retinal circulation could be demonstrated even immediately following the second ligature.

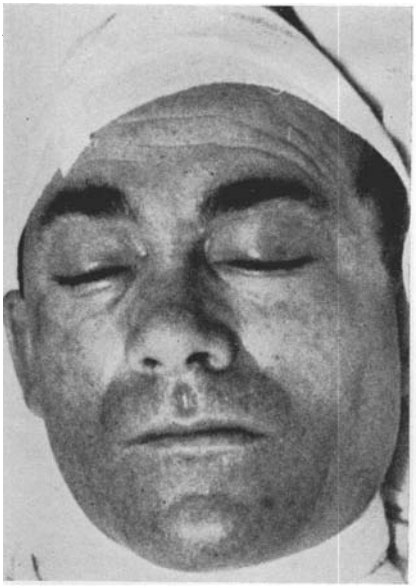
It is interesting to note that in the absence of cerebral symptoms the cyanosis and œdema of the face were in many cases very evident, sometimes most severe; as though the cerebral circulation had a sort of priority under conditions of impaired venous flow. Electroencephalography alone revealed an abnormal circulatory condition of the brain by evident flattening of tracings in all leads.

Long-term Results of Bilateral Neck Dissection

The late results of bilateral neck dissection must be considered as highly favourable and may be summarized as follows:

1. Cerebral and psychic symptoms or signs are totally absent; no headaches, no impairment of the highest psychic functions, no vertigo, no reduction of vision or of hearing. The vestibular function is normal. However, the electroencephalographic tracing is still "flat" after 2 years, and closely resembles the tracings recorded in cases of vascular encephalopathy of minor severity (arteriosclerosis).

This proves that a complete compensation in brain circulation will possibly never take place. This fact seems, however, to have no clinical significance.

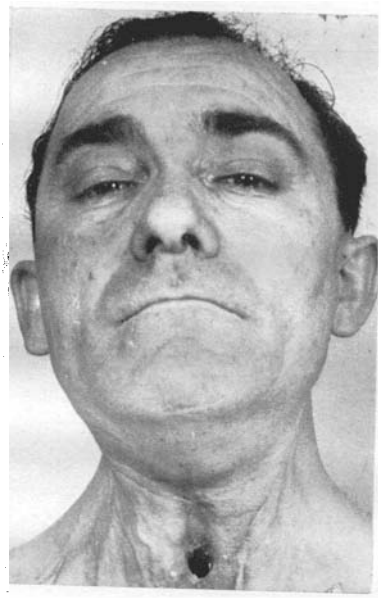


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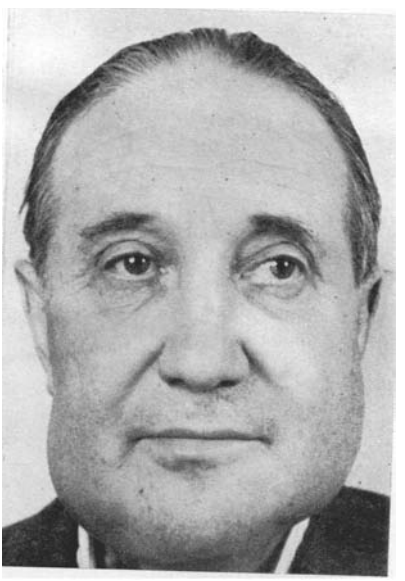
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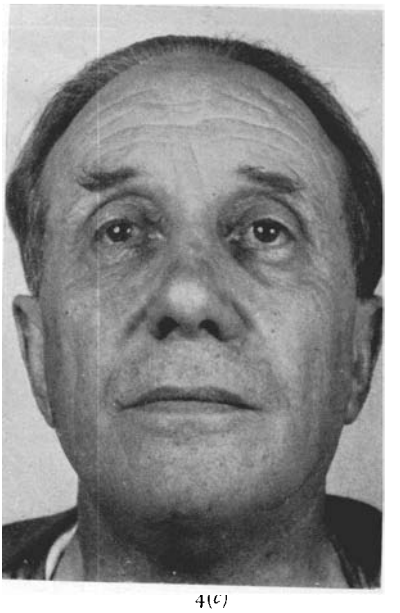
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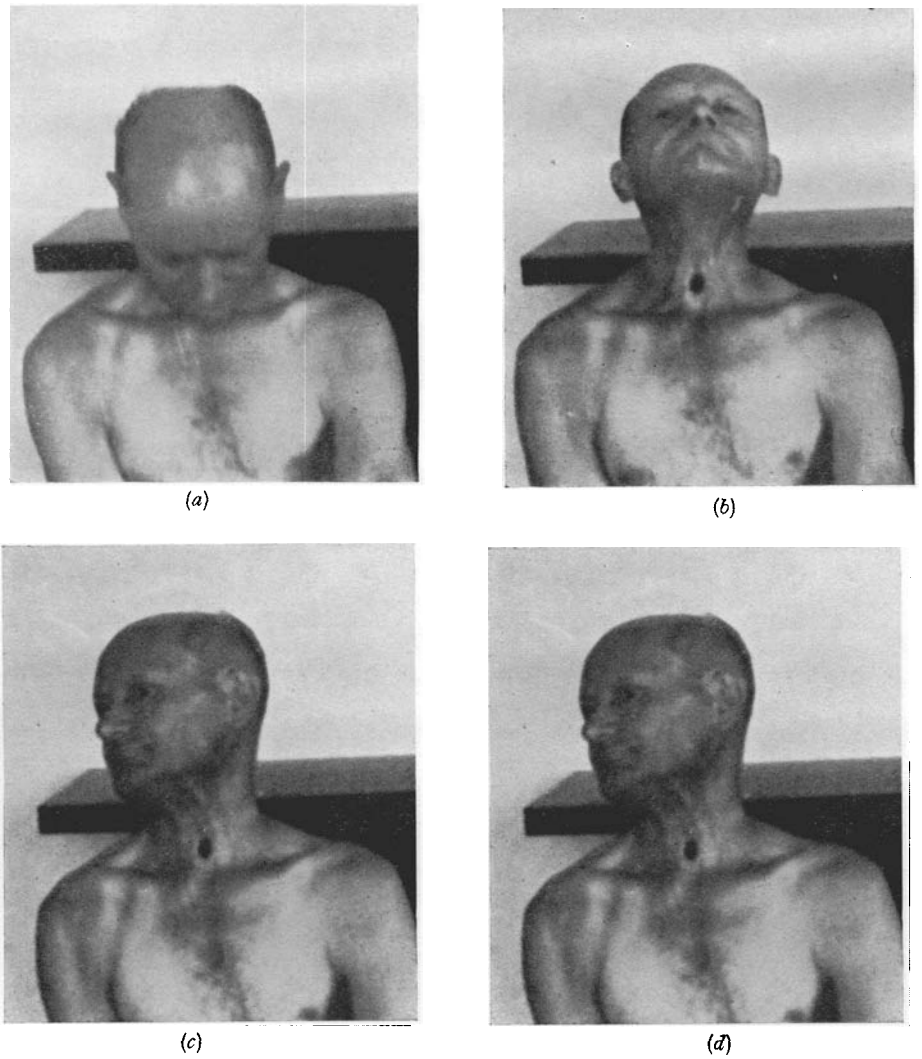
FIGS. 3 AND 4.

Appearance of two patients submitted to bilateral neck dissection. (*a*) Soon after the second dissection. (*b*) Two weeks later. (*c*) Three months later. The severity of facial œdema is well evident, together with its spontaneous regression.

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2. Facial œdema completely disappears in the course of 4-6 months (see Figs. 3 and 4), but cyanosis of the skin and mucous membrane is still evident after 3 years. Only two cases still had a hard pale œdema of the lower part of the face after 3 years, which seem to be mainly due to the lymph stasis in the soft tissues and not to venous engorgement.

3. The mobility of the head is not limited to any appreciable extent by the absence of both sternocleidomastoid muscles (see Fig. 5), although sometimes a certain limitation in the lateral rotation and flexion is



(*a*) (*b*) (*c*) (*d*)

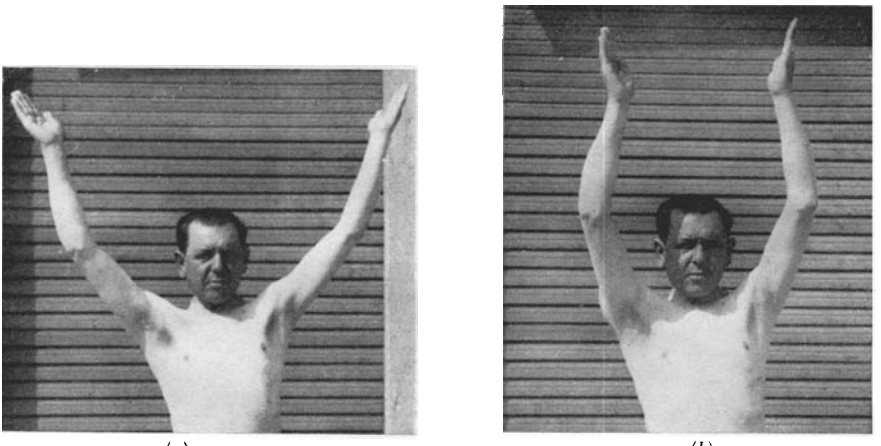
FIG. 5.

Movements of the head after bilateral resection of sternomastoid muscles: no sensible impairment is demonstrable.

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demonstrable. If the spinal nerve has been preserved, the movements of the shoulder and the arm remain normal (Figs. 6 and 7), if on the contrary it has been cut, there is a marked fall of the shoulder, the medial edge of the scapula moves away from the vertebral column and protrudes under the skin, the elevation of the arm cannot be made above the horizontal plane without prior adduction (Figs. 7, 8 and 9).

4. Pains in the shoulder and the upper arm are often complained of, due to irritation or trauma of branches of the cervical plexus, but they subside generally in the course of the first year.



(*a*) (*b*)

FIG. 6.

Appearance of a patient submitted to bilateral neck dissection with both spinal nerves preserved; no limitation in the elevation of the arms.

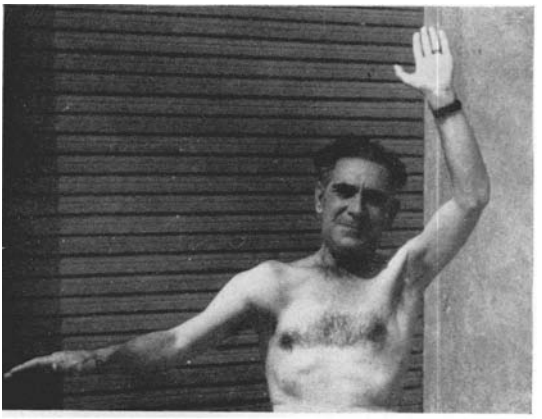


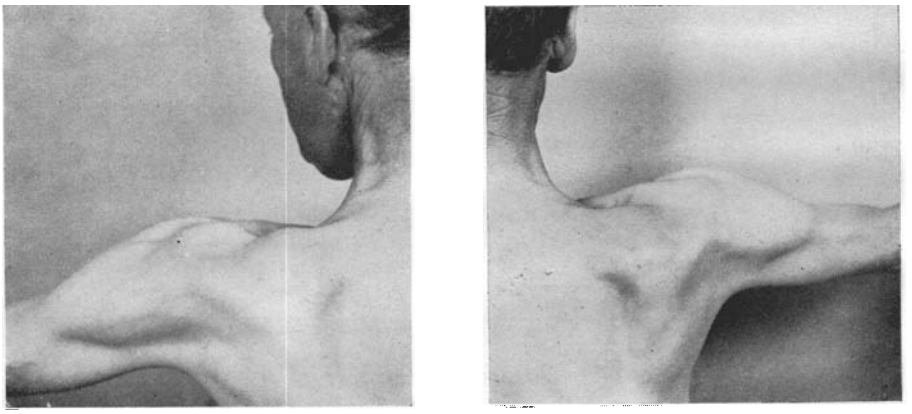
FIG. 7.

Appearance of a patient submitted to bilateral neck dissection with right spinal nerve severed and left spinal nerve preserved. The elevation of the arm is hindered on the right, normal on the left.

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5. The formation of an œsophageal voice is by no means hindered or delayed.

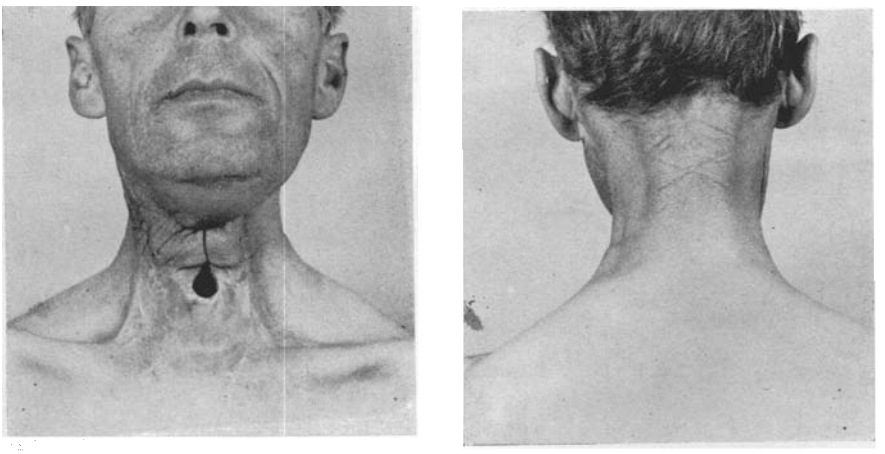
As a conclusion it may be said that radical bilateral prophylactic neck dissection in two stages is a safe surgical procedure, and its systematic adoption is advisable, in view of the far better chances it ensures of final "cancerologic" cure, when compared with the results obtained by therapeutic dissection, or by irradiation alone following laryngectomy or pharyngolaryngectomy.



(*a*) (*b*)

FIG. 8.

After effects of a bilateral neck dissection with both spinal nerves severed. The arms cannot be elevated higher than shown in the photograph.



(*a*) (*b*)

FIG. 9.

Appearance of a patient submitted to bilateral neck dissection with both spinal nerves severed. Front: marked fall of the shoulder, complete atrophy of the trapezius rim. Back: diastasis of scapulae, the elevation of the arms is limited to the horizontal plan.

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Bad circulatory effects may sometimes be observed regardless of the age of the patient and of the conditions of his cardiovascular apparatus, which cannot by any means be foreseen, dependent as they are on the functional performance of the anastomotic vessels. In any case, they tend to rapid spontaneous regression and leave no sequelae. Their possible onset, however, together with the lasting changes in electroencephalographic tracings observed in our cases, seem to be a counter indication to bilateral one-stage neck dissection. We do not deny that it may sometimes be performed when big metastatic nodes on both sides compressing the jugular veins have already diverted a part of the venous blood from the brain towards other venous channels. This was in effect the case with the patients operated in one stage by American authors and with two of our patients, where an accidental wound of the contralateral internal jugular vein in the course of unilateral therapeutic neck dissection made it necessary to ligate the second jugular vein at the same time. Both patients made an uneventful recovery.

However, we are of the opinion that even in the case of therapeutic dissection a three weeks delay between the first and the second dissection would not lessen the chances of surgical cure and would better prevent possible serious accidents. In all cases, prophylactic neck dissection as adopted by us, makes such risky surgical procedures, as those undertaken by American authors unnecessary.

The greatest care must be taken in order to preserve the important nerve trunks innervating the face and the shoulder. In effect, the circulatory consequences, serious as they may be, subside spontaneously and do not leave traces; while the motor consequences remain, and may prove the most serious drawback to a widespread adoption of the bilateral prophylactic dissection.

Conclusions

1. Prophylactic bilateral radical neck dissection in two stages is a safe procedure and should be resorted to whenever indicated, that is whenever an extraglottic cancer invades both sides of the larynx, even in the total absence of clinical metastases.

2. It affords much better chances of cancerologic cure than X-ray therapy on the cervical lymph nodes or therapeutic neck dissection.

3. It allows the necessary interval of time to elapse between the first and second operation, thus preventing, as far as possible, the onset of dangerous circulatory effects: such effects, when present, are never fatal and are easily and rapidly compensated.

4. It allows a systematic preservation of the spinal nerve, possibly also of the mandibular branch of the facial nerve, thus avoiding any postoperative impairment of the motor functions. Such preservation is seldom possible in therapeutic dissection when the lymph nodes are adherent to the surrounding tissues.

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These advantages should not fail to persuade the majority of laryngologists to adopt the method systematically in selected cases.

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