evacuee children tested soon after their arrival in our areas yielded much the same results. In sharp contrast a small sample of local children tested at the outset of the campaign in 1936 showed an extremely low percentage of natural Schick-negatives, and among the "under-fives" local experience has failed to reveal any evidence of natural immunizing processes. This is indeed to be expected from the rarity of diphtheria and the essentially rural character of the environment. On the other hand, certain feebly positive children, when tested again six months or more later and without any further treatment, were found to have become negative. The small amount of toxin introduced during the test may contribute to this result, as also may intercurrent disease and fluctuations in the general health. But the considerable changes in the hygienic adjustments of the community that have taken place during the last few years can hardly have failed to affect the oecology of the diphtheria bacillus in these areas. Year by year as the campaign progresses a large body of potential carriers is forming among the locally immunized children, and this has doubtless already built up the naturally or artificially acquired level of immunity and thus serves as a buffer against the large-scale introduction of new sources of infection. It seems probable, therefore, that natural processes are at work, though probably to a limited extent, among our local children at the present time.

What they style the "carrier menace" is a favourite target for the opponents of immunization. These people seem unable to grasp that immunization does not confer protection directly against the bacillus itself, but against its toxin, which causes the symptoms. Once this result is attained the child is at liberty to develop, according to his resources, an antibacterial immunity. Naively enough, these leave-it-to-Nature enthusiasts, while roundly abusing the immunized carrier, alternately extol and conveniently ignore, according to the angle of their attack, the great body of naturally immune town children, all likewise potential carriers of the bacillus. They ignore, too, the value of a high carrier rate in a completely immunized child community as a beneficent factor in maintaining the immunity level.

It is evident that special importance attaches to post-Schick reactors, whether primary or secondary. We have always kept the cards of these children in a special section labelled "Post-Schick Positive," where they remain even after secondary treatment has rendered them negative.

There is no doubt that certain rare children are difficult to immunize and that success is adversely affected by tuberculosis, illness, and poor general condition at the time of treatment. There is also no doubt that local reactions are commoner after A.P.T. than after T.A.F., especially in children over 8 years of age and in girls with well-developed arms. Cold saline compresses are apparently the best treatment. The dosage we use is 0.3 and 0.5 c.cm. A.P.T., and a slightly smaller first dose in children over 8.

Summary

An account has been given of an investigation into the duration of artificial immunity against diphtheria in a country area with a child population (1 to 15 years) of 9,600, 95% of whom had been immunized.

Over 3,000 children were Schick-tested two to six years after completion of a course of immunization. None of these was positive when tested three to six months after the course.

The figures indicate that the number of treated children who lose their immunity to diphtheria increases steadily with the passing of time, rising from 4% after two years to 18% after six years.

The figures should be compared with the results obtained by the routine testing, three to six months after the completion of the course, of all inoculated children—i.e., 2% primary failures.

Certain factors having a possible bearing on the results are discussed, such as the number of notified cases of diphtheria from 1936 to July, 1943 (54), 30 of whom were under 16 years of age.

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Deaths from motor accidents throughout the United States in the first six months of 1943 totalled 10,030, a reduction of 41% from the total of the comparative period in 1941 before the outbreak of the war and 32% in 1942.

GUNSHOT WOUND OF THE INNOMINATE ARTERY

BY

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The following case of spontaneous arrest of haemorrhage from a through-and-through wound of the bifurcation of the innominate artery with resultant hemiplegia from cerebral ischaemia presents several interesting features.

Clinical History of Case

An American rear gunner aged 23 was injured in a plane by an enemy cannon-shell fragment at about 7.30 o'clock in the morning. He collapsed shortly after the injury, and was given first-aid treatment by his captain, who administered two tablets of benzedrine, which helped to revive him; morphine was thought to be inadvisable. A very difficult return journey ensued, with a "belly landing" and only one engine working; he was then conveyed nearly 30 miles by ambulance, to be admitted to hospital at 1 p.m.

On admission he was severely shocked; the front of his voluminous flying kit was soaked with blood, but there was no active haemorrhage. He was conscious, but had moments of confusion; he complained of a feeling of pins-and-needles in his left wrist and hand, which he could not move. There was a round wound half an inch in diameter just above the midpoint of the left clavicle, with some swelling in the deep tissues. Blood pressure was 90/?, and the pulse rate 48, irregular. There was no obvious haemothorax or paralysis elsewhere, but he was too shocked to undress, and resuscitation with serum was started.

One hour later a blood count showed 3,600,000 red cells and 67% Hb. Blood was now being transfused. At this time he was complaining of paraesthesia in the whole of the left arm, and in view of the left brachial monoplegia a provisional diagnosis was made of possible left brachial plexus lesion due to transverse passage of the shot. A radiograph taken through his clothes revealed a cuboidal metal foreign body, 1 c.cm. in size, behind the right side of the manubrium sterni at the level of the first chondro-sternal junction; this caused revision of the diagnosis to possible carotid arterial spasm with cerebral monoplegia. A general neurological examination was still not possible, but no abnormality was noted in the legs. The pupils were normal after allowing for the effects of morphine.

At 4 p.m. he was becoming increasingly confused and disoriented and was not responding to resuscitation, but no active haemorrhage was detected. A small dose of intravenous pentothal was given to enable his flying kit to be removed by the use of scissors and wire clippers in view of the use of electric warming devices. A radiograph of the chest now showed no abnormality. At 5.30 p.m. intermittent tonic contractions of the left arm occurred and his left leg was partly paralysed. He was becoming increasingly restless and at times lapsed into coma. His pupils were dilated and reacted sluggishly; the right disk was paler than the left and the vessels appeared somewhat contracted. There was an extensor plantar response on the left, with ankle clonus; abdominal reflexes were absent, and it was obvious that a progressively severe cerebral ischaemia was present over the right hemisphere. Blood pressure was 110/45; pulse 80.

It was evident that unless the carotid arterial spasm could be relieved the cerebral damage would be fatal: no carotid or temporal pulse could be detected on the right side, and arteriotomy or novocain blockage of the periarterial sympathetics was considered justifiable.

Operation

This was performed at 8 p.m. under intratracheal anaesthesia. A transverse incision above the right clavicle enclosing the wound, with a vertical extension up the sterno-mastoid muscle, gave adequate exposure of the common carotid. The sheath was infiltrated with blood and the artery was small in calibre owing to spasm. It was traced down, and further exposure was obtained by medial reflection of the sterno-mastoid and pretracheal muscles. The wound-track was traced downwards to the back of the sterno-clavicular joint, and the common carotid was visible up to the bifurcation of the innominate; it was still in spasm though a slight pulsation was felt. At the innominate bifurcation a blue-domed clot was seen on the anterior surface, and it was evident that a puncture had occurred at this site. The innominate artery had to be controlled, and accordingly the inner third of the clavicle was divided and resected with a small portion of the manubrium sterni. Exposure of the innominate was now sufficient to allow it to be gently cleared for the passage of a tape ligature, but at this stage the clot shifted and severe haemorrhage from the bifurcation had to be controlled

by digital compression while the tape was passed. The innominate was compressed while the tape was tied, but this failed to control the bleeding, as the wound was exactly at the bifurcation. Tapes had therefore to be applied to the common carotid and subclavian arteries to maintain haemostasis. Inspection then revealed the presence of an exit laceration of the posterior wall of the innominate artery just below the bifurcation. The wound was bathed with 2% sodium citrate solution and the anterior perforation closed with paraffined fine silk sutures on arterial needles. Suture of the more ragged posterior tear was more difficult, and after release of the tape on the carotid the posterior repair leaked: a piece of muscle was applied in support of the suture, but at the second attempt at release the vessel tore further and suture had to be abandoned. Resection of the bifurcation was therefore carried out after applying double ligatures of thick silk to the innominate, common carotid, and subclavian arteries; as a further precaution against the arterial spasm novocain was injected into the adventitia. Sulphathiazole cream was inserted into the wound, which was rapidly closed.

It was interesting to note that the blood pressure rose from 120 during the preliminary clearance of the vessels to 146, 160, and 184 mm. Hg during the successive ligations of the innominate, carotid, and subclavian arteries; while the pulse rate varied from 110 to 128, 150, and 160 during the corresponding phases.

No search for the foreign body was made. Blood transfusion had been continued throughout the operation and afterwards. Pulmonary oedema developed during the night, and the patient never regained consciousness, though he became very restless. Paralysis of the left side remained, but the right limbs moved. Reflexes were sluggish or absent. The right radial pulse was feebly detected on the following morning, but no temporal pulse was present.

Death occurred 16 hours after the operation; no post-mortem examination was obtainable.

Discussion

Cerebral symptoms, usually hemiplegia, followed in 29.6% of 27 cases of ligation of the common carotid artery for gunshot wounds in the last war (Makins, 1919) only 1 out of the 8 cases presenting cerebral symptoms returned to a normal state.

In the present case the bifurcation of the innominate artery was the site of the rupture; the cerebral symptoms began within five hours of the injury, and may therefore be ascribed to spasm of the carotid, aided presumably by some intramural clotting and by general anaemia and low blood pressure. The effect of low blood pressure in producing organic cerebral damage has been dramatically demonstrated by Poppen (1939), who found that if the blood pressure was corrected by intravenous transfusion before ligation of the anterior cerebral artery no prolonged coma resulted, whereas a fatal coma was inevitable if at the moment of ligation the pressure was subnormal. Babinski remarked that an obliterated artery is a sympathetic nerve and that it is better to divide a main artery than to ligate it in continuity. Leriche (1940) postulates "cross-road zones" at the bifurcation of the main arteries, at which sympathetic vasoconstrictor impulses are initiated; he advocates division of the vessel between ligatures and injection of a local anaesthetic into the periarterial sheath.

In the case now reported a lesion of the common carotid was thought most likely as, although the foreign body was behind the manubrium, damage to the innominate with survival was considered impossible; spasm of the carotid was obvious, but similar spasm of the subclavian supply zone was not detected. Relief of the carotid spasm and the prevention of reactionary haemorrhage were considered to warrant operative intervention.

The innominate artery has been tied on many occasions for aneurysm: Sir William Wheeler (1942) reported a case of ligation of this vessel for traumatic subclavian aneurysm in 1932, and estimated that up to 1942 there had been about 70 cases of ligation for aneurysm; Ballance (1921) reviewed 57 cases, with 19 recoveries. Wheeler (1932) advocated division of the inner two inches of the clavicle, together with partial division of the right upper quarter of the manubrium sterni with retraction of the clavicle upwards and to the left; in the present case a resection of the clavicle at the sternoclavicular joint afforded reasonable exposure. Wheeler used three catgut ligatures, but Reid (1934) preferred stout silk and disliked the presence of a third coapting ligature for fear of erosion of the vessel wall; in this he agreed with Halsted, whom he quotes at length concerning eleven essential points

in the technique of arterial ligation. For large arteries it is agreed that temporary compression before tightening the ligature is essential in order to prevent intimal rupture.

Experimental work by Isenberger and Carroll (1939) showed that pedicled muscle flaps wrapped around incised wounds of carotid and femoral arteries of dogs caused effective haemostasis and permanent healing, with patency of the vessel. The muscle was opposed to the wound in the artery for about ten minutes or sutured around as a cuff without stitching to the vessel wall: endothelial lining regenerated and thrombosis did not occur when living pedicle grafts of muscle were employed. It is therefore interesting to speculate whether such treatment would be justifiable in dealing with the lesion now described: but it seems likely that in the presence of a bullet-wound contusion and rupture satisfactory adherence of the graft would not be feasible, and clot formation had already started. The experimental conditions might not obtain in the severe through-and-through wound described, and the arterial spasm would not be relieved.

Summary

A patient temporarily survived a through-and-through gunshot wound of the bifurcation of the innominate artery, and spontaneous arrest of haemorrhage occurred.

Traumatic arterial spasm of the common carotid artery resulted in rapidly progressive contralateral hemiplegia, which demanded an attempt at operative relief.

Attempted arterial suture of the injured bifurcation having failed, it was necessary to perform triple ligation of the innominate, subclavian, and common carotid arteries to ensure haemostasis. Resection of the artery was performed to interrupt the sympathetic pathways.

A brief commentary on arterial ligation and resection is included, with special reference to ligation of the innominate artery.

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TUBERCULOSIS IN LONDON

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This brief note carries forward for another year the account given in an earlier issue (Daley and Benjamin, 1942) of the effect of the impact of war upon the incidence of tuberculosis in London. The statistics of the notifications of new cases in 1942 are as follows:

TABLE I.—New Cases of Pulmonary Tuberculosis notified in London (Administrative County), 1938-42

Age Group	1938		1939		1940 (a)		1941 (a)		1942 (a)	
	No.	Rate per 1,000	No.	Rate per 1,000	No.	Rate per 1,000	No.	Rate per 1,000	No.	Rate per 1,000
0-4	105	0.42	76	0.40	60	0.53	104	1.64	101	0.73
5-14	228	0.42	161	0.39	103	0.55	198	1.74	223	0.95
15-24	1,484	1.52	1,353	1.43	1,130	1.42	1,150	1.89	1,210	1.97
25-64	3,262		2,917		2,592		2,631		2,548	
65+	224		236		202		250		225	
Not stated	2		24		18		24		26	
Total	5,305	1.31	4,767	1.26	4,105	1.33	4,357	1.87	4,333	1.80
Ratio to 1938 (%)	100		96		102		143		137	

(a) Excluding non-civilians.