Subjects who coughed intermittently also had syncope. Arterial pressure and peripheral blood flow records showed vasodilatation following this form of coughing in contrast to the vasoconstriction which resulted from the Valsalva manoeuvre and continuous coughing.

It is suggested that vasodilatation following intermittent coughing is due to the stimulation of baroreceptors by large arterial cough transients.

Intrathoracic pressure remained elevated about 10 mm. Hg for many seconds following intermittent coughing.

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EFFECTS ON BLOOD PRESSURE OF VENTRICULAR ASYSTOLE DURING STOKES-ADAMS ATTACKS AND ACETYLCHOLINE INJECTIONS

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Ventricular standstill may occur spontaneously in cases of heart-block, and during Stokes-Adams attacks consciousness is lost if asystole is sufficiently prolonged. Cardiac arrest also follows the intravenous injection of acetylcholine, with resulting loss of consciousness (Phillips *et al.*, 1952). Observations have been made to determine the peripheral arterial pressure in these two types of case, and the results are reported in this paper.

Blood pressure was recorded continuously in the brachial artery, using a capacitance manometer (Hansen, 1949). The Stokes-Adams attacks occurred spontaneously in a patient with heart-block, who later showed no macroscopic heart lesion at necropsy. Rapid intravenous injections of 50 to 200 mg. of acetylcholine chloride were given as a part of routine therapy to psychoneurotic patients who had no organic circulatory abnormality on clinical examination.

Results

The blood-pressure records in both types of case show a striking similarity. Typical examples are shown in Figs. 1 and 2. Ventricular asystole was always followed by an acute

fall in blood pressure. With prolonged standstill, blood pressure fell rapidly at first, then more slowly, and finally remained constant at about 20–25 mm. Hg. Loss of consciousness was often followed by convulsive movements.

When ventricular contractions were resumed an "overshoot" was seen on all blood-pressure records: systolic and diastolic pressures rose above control levels for a variable number of seconds before the blood pressure returned to normal. An increase in pulse pressure, more striking in the Stokes-Adams attacks, was recorded during the overshoot. The characteristic flush which accompanied restoration of the circulation following the Stokes-Adams attacks was also observed after cardiac arrest from acetylcholine injection.

FIG. 1.—Effects on the blood pressure of a Stokes-Adams attack. Above: Lead II of the electrocardiogram. Convulsive movements produced interference with the record after 16 seconds asystole. Below: Continuous brachial arterial pressure record. Time (top) in seconds. Calibration in mm. Hg.

FIG. 2.—Effect on the blood pressure of cardiac arrest produced by 100 mg. of acetylcholine given intravenously. Period of injection is shown by signal on time marker. Time in seconds.

Discussion

In spontaneous and induced ventricular asystole, blood pressure falls rapidly to syncopal levels. Systemic arterial pressure tends to stabilize during cardiac standstill at 20–25 mm. Hg. This figure does not differ greatly from the standing pressure of 14 to 22 mm. Hg observed by Dowling *et al.* (1952) during asystole induced for 5 to 10 seconds by carotid sinus pressure. These authors, however, did not record a subsequent overshoot in the systemic pressure.

The overshoot may be regarded as a response to the lowered blood pressure. A similar overshoot follows the fall in effective systemic pressure during the Valsalva manoeuvre (Hamilton *et al.*, 1936; Howard *et al.*, 1951), where it has been shown to be due to sympathetic vasoconstriction (Wilkins and Culbertson, 1947). Vasoconstriction has been demonstrated in muscle vessels during the overshoot of the Valsalva manoeuvre (Howard *et al.*, personal communication); but vasodilatation may be present in the vessels of the skin during the overshoot after asystole, since vivid flushing of the face and neck occurs in both Stokes-Adams attacks and after intravenous acetylcholine injection.

The striking similarity between acetylcholine-induced asystole and spontaneously occurring Stokes-Adams attacks suggests that these effects of intravenous acetylcholine injections result from asystole alone.

Summary

During ventricular asystole in spontaneously occurring Stokes-Adams attacks and following rapid intravenous injections of acetylcholine systemic blood pressure fell to low levels.

During cardiac standstill of up to 21 seconds arterial pressure remained constant at 20 to 25 mm. Hg.

An "overshoot" occurred in the blood pressure following the resumption of ventricular contractions in both forms of asystole: systolic and diastolic pressures increased above control levels before arterial pressure returned to normal.

It is suggested that this action of intravenous acetylcholine results from asystole only.

The cases investigated were under the care of the physicians to St. Thomas's Hospital and the National Heart Hospital.

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Review of Literature

Reports of hiatus hernia complicating pregnancy are infrequent. All authors emphasize that symptoms are aggravated by recumbency, worsen in the last trimester, and tend to clear up after delivery. Heartburn is particularly constant. Evans and Bouslog (1940) reported four cases in which this symptom was almost intractable, and Bush (1950) reported a similar case in which radiation of the pain to the ears was a bizarre addition. Vomiting may be severe and often culminates in haematemesis, which has been described by Schnepf (1943), Queries and Minor Notes (1937), Bourgeois and Hood (1949), Simmons *et al.* (1950), and Hahn (1952). Murless (1947) reported two cases of large para-oesophageal herniae causing vomiting and dyspnoea in pregnancy. Penman (1951) added to the literature four cases in which hiatus hernia produced persistent gastrointestinal disturbances during pregnancy.

Vinson (1921, 1923) described nine cases of oesophageal stricture following severe vomiting in pregnancy. Some of the records of these cases suggest that they were due to hiatus hernia. Rennie, Land, and Park (1949) described five cases of pregnant women who developed dysphagia and retrosternal pain in the latter months of pregnancy. Hiatus hernia associated with a short oesophagus and stricture was present in all five cases. In three, active oesophageal ulceration was demonstrated. Allison, Johnstone, and Royce (1943) described a similar case.

Case Reports

The following cases came to our notice during routine duties in 1950-2.

Case 1.—The patient, a 2-gravida, 1-para aged 31, was a thin woman whose previous health and first pregnancy were entirely normal. Her second pregnancy (estimated date of delivery, October 2, 1951) was complicated. Morning nausea and retching began at the sixth week and persisted throughout pregnancy. During the second trimester there were repeated attacks of "burning" pain behind the xiphoid, exacerbated by meals, recumbency, and stooping forward. Symptoms were worse at night and during the third trimester. Vomiting became so frequent that she was admitted to hospital at the thirty-eighth week and treated symptomatically. Her condition fluctuated until September 24, when, with the spontaneous onset of labour, vomiting culminated in a haematemesis. Labour was inert, and copious vomiting resulted in dehydration and ketosis. Intravenous fluids and gastric aspiration were begun, but a second haematemesis occurred which required blood transfusion. After spontaneous rupture of the membranes her condition improved and normal delivery followed. During the puerperium there were no untoward symptoms. On the ninth day a barium-meal examination showed a small para-oesophageal hernia without oesophageal ulceration or stricture. The stomach and duodenum were normal. We have been unable to trace the patient for a follow-up.

Case 2.—A 4-gravida, 3-para aged 32 attended the antenatal clinic at 20 weeks; the estimated date of delivery was January 8, 1952. She was a thin woman and complained of nausea, heartburn, and retching dating from the first month. No abnormality was found on clinical examination. At subsequent visits she reiterated these symptoms, for which a variety of alkaline medicines gave little relief. During the last trimester she emphasized that the heartburn was much worse at night, was better when she got up to vomit, only to recur when she lay down. From the thirty-eighth week the pain was noted to radiate up to the neck, and there was occasional dysphagia. On January 4 she vomited a few ounces of bright-red blood and was admitted to hospital. She responded fairly well, being nursed propped

HIATUS HERNIA AND PREGNANCY

A REVIEW OF NINE CASES AND THE LITERATURE

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Herniation of part of the stomach through the oesophageal hiatus of the diaphragm is a fruitful source of errors in diagnosis. Although this disorder is being detected more often (Avery Jones, 1952), it is still commonly overlooked.

Hiatus hernia is probably due in most cases to factors operating in adult life. Laxity of the tissues, with deficiency at the oesophageal ring, is common (Harrington, 1945). Hernia at this site is favoured by conditions raising intra-abdominal pressure and by recumbency. Such herniae may be oesophago-gastric or para-oesophageal, termed by Allison (1951) the sliding and rolling types, which may be present together.

The symptoms are protean, and have been well described by Nicholson (1952). Epigastric discomfort and vomiting are common. If the disorder is complicated by reflux oesophagitis there may be intense "burning pain" behind the lower end of the sternum, which may radiate up to the neck. There may be slight dysphagia, and a gastric ulcer may develop near the cardia. Retching of blood-stained fluid may proceed to frank haematemesis and melaena. Stricture may develop at the lower end of the oesophagus.