

# Syme's Amputation for Gangrene from Peripheral Vascular Disease

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Peripheral vascular disease as a cause of amputation was first forcefully brought out in Canada by the many cases of acute thromboangiitis obliterans occurring in young men after World War I. In the early days of the 20's, amputation for this disorder was carried out at knee level (Gritti-Stokes), an operation itself considered a daring innovation at the time, the site of election in such cases then being viewed as the junction of the upper and middle thirds of the thigh. In the present series, the first Syme amputation for gangrene of the foot was performed in 1925 in a case of thromboangiitis obliterans. Since that time, the Syme amputation has been used in Canada in such cases whenever it seemed warranted.

By 1940, Syme's amputation had been used successfully for many and varied conditions, including infected and perforating ulcers in unrecovered sciatic-nerve and cauda-equina lesions, septic and tuberculous arthritis of the ankle joint, frostbite, arterial occlusion, and gangrene owing to peripheral arterial disease.

<sup>1</sup> Present address: 84 Woodlawn Ave., E, Toronto, Ontario, Canada. Until his retirement in May 1956 as Chief of the Orthopaedic Service at Sunnybrook Hospital, Toronto, Dr. Dale had for more than 35 years (since October 1920) been in charge of all amputations for the Canadian Department of Veterans Affairs at Christie Street Hospital and at Sunnybrook. His patients have been drawn not only from World Wars I and II, the Korean War, the Boer War, and the Northwest Rebellion but also from many lesser campaigns in many parts of the world, from the Canadian Mounted Police, from the Canadian Department of Indian Affairs, and, until recently, from Canada's active Army. The cases here reported upon are of interest for at least two reasons—first because a goodly number were followed for periods ranging from five to 22 years (or until death from other causes), second because Dr. Dale either has performed the operation himself or else has served as the supervisor.—ED.

When, after the beginning of World War II, the question of amputations once again became prominent, we were able to refute the views expressed by the British Ministry of Pensions in regard to Syme's and other end-bearing amputations generally.<sup>2</sup> We showed, by demonstration of actual cases, the great value and durability of these amputations in active life. We were fortunate in having an excellent prosthetic service started during World War I and concentrated in February 1919 at the Dominion Orthopaedic Hospital (later Christie Street Hospital). It had constantly been improving our prostheses, and to that group we owe much of our success.

During the period 1920-1956, many new factors modified our views and methods of treatment. In 1930, lumbar ganglionectomy was adopted in vascular disease, and it is thought that doing so saved or postponed many major amputations. Embolectomy and anticoagulants saved some limbs. Sulfa drugs, penicillin, and later antibiotics bolstered our courage. Although the incidence of infection was no lower after than before the use of such agents, there were operated upon during World War II cases that in World War I would not even have been considered for surgery. Now arterial grafting promises well in selected cases. Advances in anesthesia and in medicine generally have of course helped a great deal. Of the problems facing the Department of Veterans Affairs today, one is senile gangrene owing to the advancing age of veterans.

## CASE HISTORIES

The case histories that follow represent most of the Syme amputations performed for gan-

<sup>2</sup> *Artificial Limbs and Their Relation to Amputations*, British Ministry of Pensions, His Majesty's Stationery Office. London. 1939.

grene owing to thromboangiitis obliterans, diabetic gangrene where there was also peripheral vascular disease, and senile gangrene from arteriosclerosis *per se*. Omitted are those cases whose files were destroyed after death, but all failures are recorded. Included are 23 Syme amputations and one mid-tarsal amputation, all for vascular disease and all with gangrene. Six have undergone reamputation.

Cases 3, 6, and 7, listed under thromboangiitis obliterans, each underwent reamputation within six months and must therefore be classified as failures. Two cases (17 and 22) listed under arteriosclerotic gangrene are doubtful operative failures. The first underwent reamputation after his stump had healed and he had walked quite well. The reason for reamputation apparently was not breakdown of the stump. The stump of the second healed *per primam*. Fitted at an early date, the patient bore his weight chiefly on the stump for 18 months. Case 9, discussed under diabetic and arteriosclerotic gangrene, is considered a success. Not only did he wear his limb for nine years but his stump breakdown was occasioned by neglect and later circulatory failure from myocardial infarction. Cases 16 and 19 (arteriosclerotic gangrene) had well-healed stumps and were fitted but never wore their limbs to any useful extent. They are therefore recorded as failures.

There are thus seven failures in 23 cases (roughly 30%). So marked is the prevalence of myocardial infarction in thromboangiitis obliterans at all ages that an electrocardiogram and cardiovascular examination are now part of our routine examination.

#### CASES OF THROMBOANGIITIS OBLITERANS

##### CASE 1. (W. E.)

Male, born 1891. Served in the Imperial Army, 1914—19. Wounded and had trench feet in service. On discharge, complained of painful feet and occasional cramp in right calf. Had two attacks of phlebitis. Was doing heavy work.

Admitted to Christie Street Hospital 1924 with localized gangrene, dorsum of right foot, arising from infection between second and third toes. Severe pain. No pulse below the femoral on the right side, weak pulsation in dorsalis pedis and posterior tibial arteries on the left.

Right Syme amputation 1925, healed *per primam*. Case followed until 1947, when patient returned to England. No trouble with stump. Increasing disability

in left leg had forced change to light work. Arterial pulsation below the femoral had disappeared. Left radial pulse absent. Patient had not smoked since 1924.

Patient failed to communicate further as promised.

##### CASE 2. (R. G.)

Male, born 1900. Served in Army, 1915-19. V.D.S. on service. Subsequently worked as teamster in the bush. Had frequent mild attacks of frostbite. Patient's feet were cold in winter, scalded in summer. Had claudication of left leg 1934. In the winter of 1934-35, left foot was frozen, and gangrene of the left great toe developed. Amputation of toe was performed at local hospital. Wound did not heal for nine months.

In February 1936, right foot was frozen, right fifth toe amputated. Wound failed to heal and gangrene extended. Patient was referred to a city hospital, where thromboangiitis obliterans was diagnosed and a right lumbar ganglionectomy was done in March 1937. In May and November, same year, toes were amputated. Gangrene extended slightly.

In November 1937, patient was admitted to Christie Street Hospital with gangrene involving the distal third of the right foot. Marked equinus deformity. No palpable pulsation in arteries below the femoral on either side. Vein filling on the right, two minutes. Patient had suffered great pain and was practically a morphine addict.

Right Syme amputation in December 1937. Slight necrosis at center of wound, but stump healed well. Patient fitted and walking in March 1938.

Patient readmitted in April 1939 for disabling claudication of left leg. Findings as before, except that vein filling was 90 seconds. Left lumbar ganglionectomy done with excellent result. Patient seen February 1940, March 1943, April 1945, December 1946, and January 1947, all for minor infections, left foot, due to lack of cleanliness, a carbolic-acid burn, and an artefact. Left Syme amputation, performed July 1947, healed *per primam*.

Review in June 1948 showed excellent stumps. Patient walking well and working at woodcutting. Doing well 1953, when photograph of stumps (Fig. 1) was taken. Death for coronary thrombosis in 1954.

##### CASE 3. (T. A.)

Male, born 1886. Served in Army 1914-19. V.D.S. on service. Alcoholic. Onset vague pains in feet 1915. Nothing definite noted on discharge. Subsequent attacks of phlebitis, diagnosed as thromboangiitis obliterans 1928. Patient then had absence of pulsation both arteries right foot and in the left dorsalis pedis. Erythromelia was marked. Vein filling, 30 seconds. Admitted to Christie Street Hospital 1936. Right lumbar ganglionectomy in November 1936. Much improved. Admitted Christie Street in February 1937. Sudden onset gangrene right foot and leg. Right Gritti-Stokes amputation performed in March 1937. Healed well. Fitted with limb and walking, June 1937.

Admitted Christie Street Hospital in February 1938. Gangrene of toes, left foot. No pulse below femoral. Left lumbar ganglionectomy, performed in March 1938, produced some improvement, but patient

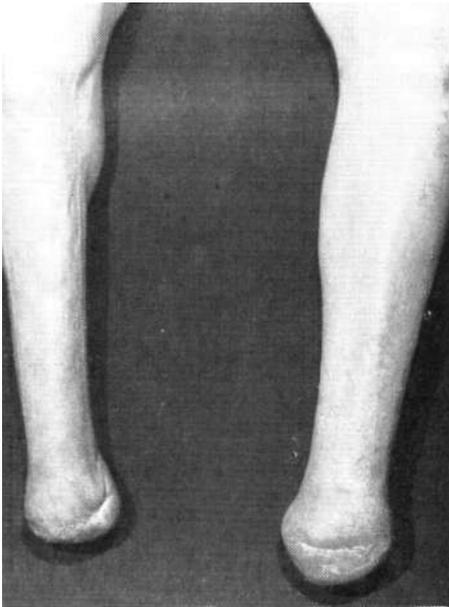


Fig. 1. Case 2 (R. G.). Anterior view of bilateral Syme stumps. Right (viewer's left), 16 years after amputation; left (viewer's right), six years.

complained greatly of pain. Left Syme amputation, May 1939. Heel flap did not slough, but wound healed slowly. Well healed in November. Patient refused to bear weight on Syme stump and complained so bitterly of pain that a left Gritti-Stokes was carried out.

Patient thereafter made no attempt at walking. Remained an invalid until death from coronary thrombosis.

#### CASE 4. (R. E. C.)

Male, born 1909. In 1947, patient was admitted to a city hospital for a nonhealing infection, right great toe nail. Thromboangiitis obliterans diagnosed and bilateral lumbar ganglionectomy performed. Right great toe was later amputated, and wound healed slowly. In 1949 and 1950, two other toes, right foot, were amputated. Right below-knee amputation, done later in 1950, healed fairly rapidly with some sloughing of the flaps. Four months after amputation, patient was fitted with a prosthesis and walked well. Shortly thereafter stump broke down.

Admitted to Sunnybrook Hospital, March 1951, with complete breakdown of end of below-knee stump. No pulsation below the femoral on either side. Left foot blanched sharply on elevation. Vein filling, 25 seconds.

Right Gritti-Stokes amputation in May 1951. Healed *per primam*. Fitted with prosthesis August 1951, and walked well. Readmitted in 1952 with minor infection of left foot requiring only few days to heal.

Working steadily as engineer, March 15, 1953. Sudden, severe pain in left foot, which rapidly changed color. Admitted to Sunnybrook Hospital. Purple discoloration, distal half of left foot, which did not change on application of pressure or on elevation. Discolored area insensitive. Vein filling, 25 seconds. Weak femoral pulse. Pain very severe in left leg and foot.

Treated by rest, heat, dry dressing, Buerger's exercise, whiskey, and papaverine. Pain not controlled and gangrene extended. Left Syme amputation in April 1953. Healed well with slight necrosis in small area around scar. Patient fitted in June 1953. In September 1953, developed stump abscess, which was opened widely and packed open. Secondary suture, done one month later, healed well.

Patient was walking well in June 1954. Returned to full-time work. Died suddenly in October 1954 from acute coronary thrombosis.

#### CASE 5. (W. S.)

Male, born 1914. While in Army, developed phlebitis in right foot, and claudication ensued. Symptoms increased, and thromboangiitis obliterans was diagnosed. Right lumbar ganglionectomy done and patient discharged.

Admitted to Christie Street Hospital in September 1947 with gangrene of left great toe and whole right foot extending to the leg. Condition grave. Had had steadily increasing doses of morphine but obtained little relief. No pulsation below the femoral, either side. Right guillotine amputation at level of tibial tuberosity, October 1947. Patient's condition improved rapidly and pain was largely relieved.

Left lumbar ganglionectomy six days later with good result. Disarticulation of the left great toe in November, flaps left open. Right Gritti-Stokes and left Syme December 1. Gritti-Stokes healed *per primam*, Syme showed slight necrosis at suture line but was well healed in seven weeks.

Patient was walking well in August 1948 (Fig. 2). Has worked as limbfitter ever since. No trouble, either stump.

#### CASE 6. (H. T. O.)

Male, born 1910. Sprained right ankle while in Army, pain and phlebitis in right leg subsequently. Thromboangiitis obliterans diagnosed and right lumbar ganglionectomy performed in 1943. Twice admitted to Sunnybrook Hospital in 1946, first with gangrene of fourth toe (amputated and healed), second with gangrene of great toe (amputated but did not heal). Right Syme amputation in January 1947. Heel flap did not slough, but wound did not heal. Right Gritti-Stokes, May 1947, healed promptly.

In 1951, patient underwent left lumbar ganglionectomy and amputation of a gangrenous great toe, then passed into other hands. Subsequent history includes left mid-tarsal amputation, 1952; left Syme, 1953; left below-knee, 1954; left Gritti-Stokes, 1956.

## CASE 7. (w. P.)

Male, born 1899. Discharged from Army in 1919 with history of painful feet. In September 1939, developed phlebitis of right leg with rapidly increasing claudication. Three weeks after onset, patient could walk only a dozen yards.

Admitted to Christie Street Hospital in November 1939 with ulceration and gangrene of fourth and fifth toes, right foot. Acute phlebitis at calf and at dorsum of foot. No pulsation in arteries below femoral, either side. On elevation of limb, color faded in two minutes. Vein filling, one minute.

Old thrombosed veins on dorsum of left foot and in left calf. On elevation of limb, purplish color remained for three minutes. Vein filling, 30 seconds. Right lumbar ganglionectomy November 17, 1939. Right Gritti-Stokes December 19, 1939. Left lumbar ganglionectomy April 5, 1940.

After the last operation, patient returned to work as repair man. No trouble until October 1949, when he had acute onset of pain in left foot and leg. Able to walk only a few steps. Left great toe was gangrenous, left foot livid, cold, and insensitive. Left Syme amputation performed April 1, 1950, at patient's request and against professional advice. Flap remained viable but never regained natural color; wound did not heal completely. Left Gritti-Stokes, performed June 1, 1950, healed *per primam*.

Walking on two Gritti-Stokes prostheses, patient was discharged in December 1950. Died August 1957, acute coronary thrombosis.

## CASE 8. (B. P. H.)

Male, born 1923. While in Army in 1944, sustained superficial wound of left leg. Healed, but scar frequently broke down. Patient was in Christie Street Hospital on another service in 1948 because of phlebitis and breaking down of wound scar. X-rays showed no retained foreign bodies. Femoral vein was ligated.

In a 1949 diagnostic, examination was negative except for erythromelia. Diagnosis of thromboangiitis obliterans was indefinite but patient was advised to stop smoking.

Admitted to Sunnybrook Hospital 1952. Two months previously had infection of the left great toe nail. Claudication appeared shortly thereafter. No pulse below femoral on left side. On elevation of limb, color faded slowly. Vein filling, 40 seconds. Marked erythromelia. All pulses palpable on right side. Vein filling, 15 seconds. Left lumbar ganglionectomy done with good result. Three weeks later guillotine amputation of the great toe was effected, and a month after that the stump of the great toe was disarticulated and flaps sutured. Wound healed in three weeks, and patient returned to work.

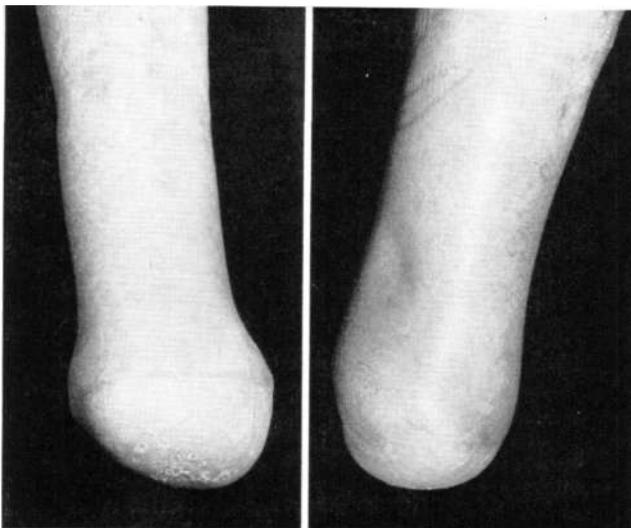


Fig. 2. Case 5 (W. S.). Anterior and lateral views of left Syme stump 11 years after amputation.

Sudden onset of pain in right leg in December 1953 following infection and gangrene of right great, second, and third toes. Admitted to Medical Service and put on anticoagulants, Priscoline, and heavy doses of morphine. Medication discontinued upon transfer to Orthopaedic Services and papaverine and whiskey substituted. When blood coagulation was again normal, right lumbar ganglionectomy was performed. Eight days later, guillotine amputation of the distal half of foot was done. Right Syme amputation, three weeks after that. Good healing. Patient was walking well on prosthesis in May 1954. Has worked steadily since and has had no trouble.

## CASES OF DIABETIC GANGRENE WITH ARTERIOSCLEROSIS

## CASE 9. (R. G.)

Male, born 1901. When patient enlisted in 1940, it was noted that the left third toe had been amputated. Subsequently, it was found that he had had diabetes prior to enlistment. Lues evident. Admitted to Christie Street Hospital in October 1940 with osteomyelitis of the tarsus and gangrene of toes. Many sinuses. Dorsalis pedis pulse absent. Weak posterior tibial. Marked neurotrophic changes. Patient emotionally unstable.

Left Syme amputation, 1941, healed well. Patient, fitted with prosthesis and able to walk well, neglected diabetic treatment and was readmitted in 1950 with ulceration in the amputation scar. Ulcer excised, stump healed. While still in hospital, patient had severe myocardial infarct and wound broke down. Gritti-Stokes was carried out.

Patient never was active, although he walked fairly well. Died in August 1954 from acute coronary throm-

bosis. Autopsy showed marked aortic degeneration with mural thrombus. Peripheral vascular endarteritis.

CASE 10. (A. E.)

Male, born 1893. Truck driver. Diabetes discovered in 1948 and patient put on diet. While in local hospital for fractured right tibia, was put on insulin. Admitted to local hospital in 1952 with ulcer on sole of right foot. With incomplete healing, patient returned to Iwork. Perforating ulcer developed, and patient was admitted to Sunnybrook Hospital in January 1955.

Examination showed extensive soft-tissue infection about a perforating ulcer. No dorsalis pedis pulse. Weak posterior tibial. X-rays showed extensive osteomyelitis (neurotrophic foot). Marked calcification of vessels. Culture showed organisms resistant to all antibiotics except terramycin.

Right Syme amputation January 31, 1955. Healed *per primam*. Fitted and walked well. Returned to work in November 1955. No trouble since.

CASE 11. (w. w.)

Male, born 1900. Diabetes recognized in 1932. In 1949, following lapse in diet, developed gangrene and osteomyelitis of right foot. Much neurotrophic change. Pulses in feet weak. Right Syme 1949. Wound healed well. Patient worked as caretaker until December 1951, when he developed infection in a callus on the left foot. Ten days later was admitted moribund to Sunnybrook Hospital. Discharging sinuses on sole of left foot, lymphangitis, and femoral adenitis. No sensation in foot. Abscess in sole drained. Patient put on antibiotics, and carbohydrate metabolism improved.

Guillotine amputation of left foot January 10, 1952, followed by marked improvement. Left Syme January 22, 1952. Some wound infection, but healed well in six weeks.

Patient is still walking on two prostheses. Is not now working, but can walk to bathroom on stumps alone (Fig. 3). Sectioned arteries in both stumps show marked endarteritis.

CASE 12. (w. c.)

Male, born 1886. Diabetes diagnosed in 1948. Admitted to Sunnybrook Hospital in 1951 on Medical Service. Diagnosis: "Arteriosclerotic heart disease; peripheral vascular disease; diabetes with peripheral neuritis; lues; gangrene of right foot." No arterial pulsations below the femorals. Gangrene in distal half of foot. Right Syme done and well healed. Fitted with artificial limb on which patient walked well.



Fig. 3. Case 11 (W. W.). Front and side views of bilateral Syme stumps. Right stump (viewer's left), after nine years; left stump (viewer's right), after six years. Corresponding x-rays show bony proliferation from subperiosteal dissection of the flaps.

Admitted 1953 with congestive heart failure and ulcer of left foot. Healed with bed rest.

In 1954, dyspnoea, swelling of limbs, nephritis, ulceration (hot-water-bottle burn) on dorsum of foot.

Admitted February 10, 1956. Died. Autopsy showed marked peripheral vascular disease, arteriosclerotic heart disease, and myocardial infarction.

CASE 13. (A. J.)

Male, born 1886. Admitted to Sunnybrook Hospital in September 1949. One month previously had developed ulcer in bunion on left foot. Two weeks later great toe "became black." Patient was found to have severe diabetes, had recently lost much weight. Femoral pulse present, no pulse below. X-ray showed osteomyelitis of first and second metatarsals.

Treated by bed rest, antibiotics, and dry heat. Fever continued, and pain increased. Great toe disarticulated

October 5, 1949, and wound left open. Temperature normal 10 days later, patient much better.

Left Syme amputation April 18, 1950. Arteries sectioned showed marked endarteritis obliterans. Stump healed well. Patient fitted in June 1950, discharged in September walking well.

Patient admitted February 1951 with uncontrolled diabetes and jaundice. Had discontinued his insulin three months previously. Died June 10, 1951.

#### CASE 14. (W. R.)

Male, born 1872. Medical graduate. Diabetes diagnosed 1941, symptoms of polyuria and foot drop. Patient was put on diet and insulin. Did not follow diet strictly and stopped insulin in 1944.

In September 1954, patient pared corn on right great toe. Infection spread over foot. Treated self. Healed in nine months.

Infection, right great toe, December 1955. Hospitalized. Healed January 1956.

Admitted to Sunnybrook Hospital February 26, 1956, with gangrene of great and second toes, right. Systolic blood pressure, 210; diastolic, 90. No pulsations other than femorals in right and left lower extremities. Treated by rest and antibiotics.

Right lumbar ganglionectomy April 13, 1956. Right Syme May 3, 1956. Healed *per primam*. Fitted in August 1956. Patient gets about well on limb and states he is still (December 1958) fairly active.

#### CASE 15. (R. C.)

Male, born 1896. Discharged from Army 1919. Diabetes diagnosed 1927. Did well on diet alone for three years. Then noticed numbness and coldness of feet. Health was poor. In 1941, patient developed septic arthritis of left knee and, later same year, of right ankle. Drained at local hospital.

Admitted to Christie Street Hospital in February 1942, very ill. Sedimentation rate, 147 mm. X-rays showed destruction of outer condyle of left tibia and erosion of lower end of right tibia and upper margin of right astragalus. Ankle joint drained and knee drainage improved. *Staph. aureus* cultured from both.

Condition improved, and carbohydrate metabolism was balanced in July 1942. Right Syme then performed, but destruction of lower end of tibia required section somewhat higher than usual. Stump healed in three weeks.

In September 1942, left knee was excised. Patient fitted with prosthesis and walking well by January 1944. Continued to wear leg until sudden death in 1947, cause unknown.

### CASES OF ARTERIOSCLEROTIC GANGRENE

#### CASE 16. (J. E. N.)

Male, born 1896. Was in good health until 1945, when intermittent claudication in left calf was noted on walking half a block. In June 1950, patient was put on Prisolone. In July, developed gangrene of fourth and fifth toes. Admitted to local hospital in August 1950 for left lumbar ganglionectomy. Fifth toe amputated,

but wound failed to heal. In January 1951, patient underwent transmetatarsal amputation.

Admitted to Sunnybrook Hospital September 20, 1951, in poor condition and in great pain. Stump foul with protruding bones. No arterial pulsations below femoral. Patient given choice of gamble with a Syme or almost certainty with a Gritti-Stokes. Left Syme performed September 24, 1951. Stump healed slowly but well. Patient discharged November 5, 1951, returned for fitting. Died of coronary thrombosis before limb could be issued.

#### CASE 17. (L. G.)

Male, born 1880. Admitted to Sunnybrook Hospital in May 1954. Two years earlier had noticed claudication of left leg. Left inguinal herniotomy performed at local hospital in January 1954. Six weeks later, patient developed infection and gangrene of left third toe. Upon amputation of toe, gangrene spread rapidly involving distal third of foot.

Weak femoral pulses. No pulsation in arteries, either foot. Left lumbar ganglionectomy May 12, 1954. Left Syme amputation May 26, 1954. Stump healed slowly but with little necrosis. Patient developed moderate flexion deformity at knee despite all efforts but was walking quite well in March 1955. Patient refused Veterans' care but did not wish to be discharged. Finally discharged walking well, September 1955.

Patient returned to home town, where for reasons unknown leg was amputated at mid-thigh level. Syme stump had not broken down. Referred back to Sunnybrook in March 1956, patient had a 45-deg. flexion deformity of the hip and could not be fitted.

#### CASE 18. (F. E.)

Male, born 1885. Worked as stableman. In summer of 1949, patient noticed fissure in skin on medial side of first tarsometatarsal joint, right. Consulted physicians and chiropodists, but an ulcer formed and increased until, when patient was admitted to a city hospital, it measured 1 in. X 1 1/2 in. Given bed rest and antiluetic treatment, patient did not improve. Right lumbar ganglionectomy was performed with poor result.

Admitted to Sunnybrook Hospital February 3, 1950. No pulsation below the femorals. Ulcer was inflamed and had become larger. Very severe pain. After treatment of a flexion deformity of the knee, a right Syme amputation was done in March 1950. Healing was complete by May. Slight marginal skin necrosis along suture line.

Discharged September 1950 walking well on a prosthesis, patient has had no further trouble.

#### CASE 19. (R. E.)

Male, born 1887. In 1939, had claudication in right leg. Right lumbar ganglionectomy done at a city hospital in 1940. Considerable improvement. In 1950, a left lumbar ganglionectomy was done for similar symptoms on the left side. In January 1951, left great toe nail became infected and was removed. Toe became red and swollen. Redness spread over whole foot, and toe

became black. Large doses of morphine gave no relief for the severe pain.

Admitted to Sunnybrook Hospital in March 1951 with gangrene affecting toes and distal third of foot. No pulsation below femoral, either limb. Left Syme amputation April 3, 1951. Completely healed May 13. Patient returned for fitting November 1951, died 1952 of coronary thrombosis.

CASE 20. (G. E. O.)

Male, born 1881. Admitted to General Surgical Service, Sunnybrook Hospital, November 1950, intoxicated. Shotgun wounds both feet—superficial on left side, marked bony destruction on right. X-ray showed bony defect in right os calcis, numerous lead pellets in region of right heel. Wound debrided and plaster cast applied. Despite antibiotics, wound became infected and foot gangrenous.

When, in February 1951, patient came under care of Orthopaedic Services, distal portion of right foot was gangrenous, and marked edema and cellulitis extended to ankle. No pulsation below femoral artery. Patient very ill. Abscess drained February 19, 1951. Eusol dressings. Right Syme February 28, 1951. Standard operation, except that no section was made of lower end of tibia or of malleoli. Wound left open. Pathological report on sectioned vessels: endarteritis obliterans. Patient improved rapidly.

Right Syme completed March 14, 1951. Malleoli removed, but tibia not sectioned. Healing good, although a small sinus persisted until May 1951. Fitted in June, patient walked well.

Hospitalized June 4, 1953, for infection about residual shot pellet. Discharged. Readmitted November 30, 1955, for bronchopneumonia and empyema. Discharged. No further trouble with stump, though health is poor.

CASE 21. (J. A. S. J.)

Male, born 1876. A blind vagrant who had slept in an open boxcar while intoxicated, patient was admitted to Sunnybrook Hospital December 27, 1951, in moderate state of shock. Toes of right foot mottled but fairly warm. Distal third of left foot purple and showing no color change on application of pressure or on elevation of the limb. Left toes livid. No sensation in distal third of left foot. Edema in left leg up to knee. No arterial pulsation below the femorals.

X-ray showed marked arterial calcification. Patient treated expectantly by antibiotics, rest and dry heat. Well-marked line of demarcation, left foot, by February 16, 1952. No loss of tissue of note, right foot. Left mid-tarsal amputation proximal to line of demarcation, March 4, 1952. Wound healed well. Stump was good, but patient walked poorly. Died February 1954.

CASE 22. (W. R.)

Male, born 1890. Complained in 1953 of coldness and pain in feet, left being most affected. Admitted to a city hospital, where left lumbar ganglionectomy was

performed. In 1954, following myocardial infarction, developed gangrene in the second and third toes on the left.

Patient admitted to Sunnybrook Hospital in April 1955 on the Medical Service. Weak pulsation in arteries, right foot. Posterior tibial absent; weak dorsalis pedis, left foot. Gangrene extended and caused great pain.

Left Syme amputation, March 1, 1956, healed *per primam*. Fitted with a prosthesis, patient had no trouble with stump. Right foot broke down, and weight was borne mainly on the amputation stump. By October 1957, patient walked with crutches and took weight on the stump only.

By January 1958, stump showed bluish discoloration and was cold. Deep fluctuation appeared and was aspirated. Two c.c. of serosanguinous fluid were obtained. Skin was intact. Disarticulation at the left knee was carried out January 29, 1958. Wound healed *per primam*, but patient has not walked since.

SUMMARY

Between October 1920 and May 1956, I personally conducted or else supervised all Syme amputations performed in the DVA Hospitals at Christie Street and Sunnybrook. Uniformly satisfactory, they resulted in durable and stable stumps. In the cases owing to vascular disease with gangrene, the amputations were equally satisfactory. Six cases (2, 6, 7, 9, 17, and 22) required reamputation. Only two were subjected to amputation for failure of healing. One (Case 9) is considered a success. Two cases (16 and 19), while healed and fitted, died before use of their prostheses and are considered failures. Stumps were in active use for periods of 22, 17, 7, 12, 4, 9, 10, 7, 5, and 5 years, others for shorter periods.

From my experience, I would venture to suggest:

1. Lumbar ganglionectomy at an early date in all cases of thromboangiitis obliterans and, should gangrene develop, Syme's amputation.
2. In diabetic gangrene where carbohydrate balance can be maintained and where minor amputations have failed, Syme's amputation.
3. In selected arteriosclerotic (senile) gangrene where ganglionectomy and arterial resection and graft have failed to arrest gangrene, Syme's amputation. These patients should understand the great risk of failure.
4. In all cases of gangrene with infection, and in diabetics with infection where carbohydrate-metabolism disturbance is not yielding to treatment, a preliminary guillotine amputation.

5. Success in the Syme, or other type of tarsal amputation, gives a degree of activity otherwise impossible. Such cases may expect trouble in the other limb.

6. Amputation between the knee and ankle (below-knee) is not advisable in cases of severe vascular disease.

7. Amputations through the knee (Gritti-Stokes) are almost always successful in healing and give good walking comfort where the patient's condition warrants. Such patients frequently have severe cardiac and cardiovascular lesions, and activity may result in sudden death.

—*G. M. D.*