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## ORIGINAL MEMOIRS

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### FATAL POST-OPERATIVE EMBOLISM.\*

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#### INTRODUCTION.

THE plugging of vessels by foreign bodies floating in the blood stream was first brought to the attention of the medical world by Virchow, to whom, indeed, we owe practically the whole theory of embolism.

His studies, made principally from 1846 to 1856, were early confirmed by numerous clinical, experimental, and post-mortem observations by others, chief among whom should be mentioned Cohnheim and Cohn. Of the latter's work, published in 1860, Welch remarks: "It is extraordinarily rich in anatomical, experimental, and clinical facts, and it is well for any one who believes that he has a new observation or opinion concerning embolism to consult it before venturing on publication; a precaution which has evidently been often neglected by writers on the subject." When with Virchow's and Cohn's work we place Cohnheim's "*Studies on the Embolic Process*," published in 1872, and Welch's classical review of "*Thrombosis and Em-*

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*bolism*," published in 1899, we have listed most of the significant literature on embolism.

It is therefore not with a hope of adding materially to any portion of the doctrine of embolism that I present the following data, but merely to place it on record that it may be used for statistical purposes in surgical prognosis, and as a basis for suggesting anew certain precautionary measures for the prevention of embolism.

#### ANALYSIS OF CASES.

From the opening of St. Mary's Hospital, Sept. 30, 1889, to Sept. 13, 1899, a period of ten years, I find no fatal case of post-operative embolism recorded in the annals of the hospital, and no sudden death which could reasonably be ascribed to such a cause, though during these ten years over 6,000 major operations were performed in the clinic.

From Sept. 13, 1899, to Dec. 31, 1911, 47 fatalities from post-operative embolism occurred. During this period of twelve and one-quarter years, approximately 57,000 major operations were performed.

Autopsies were made on 41 of the fatal cases, and the clinical diagnoses were quite positive in the remaining 6 cases. Within the same period it is true that a great many non-fatal cases of embolism were noted clinically with more or less positiveness, but the histories in many of these are too indefinite to warrant their tabulation along with the fatal cases, and a review of them is reserved for a later communication.

The cases have been grouped by years in Table I as follows :

The total number of deaths occurring in the hospital for the period under consideration, from all causes, was 864, of which the fatalities from embolism are approximately 5 per cent. The mortality from embolism, based on the 63,573 operations, is 0.07 of one per cent., or one death in every 1,352 operations. When the cases are grouped according to the anatomical re-

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<sup>2</sup> Welch : Albutt's System of Medicine, 1899, vol. vii, pp. 155-285.

gions on which the preceding operation was done, they are found to be as follows:

After 1,372 operations on blood-vessels, 2 deaths, or 0.14 of 1 per cent.

After 3,266 operations on the thyroid, 2 deaths, or 0.06 of 1 per cent.

After 2,281 operations on the mouth, 1 death, or 0.05 of 1 per cent.

After 2,391 operations on the stomach or duodenum, 3 deaths, or 0.12 of 1 per cent.

After 4,597 operations on the gall-bladder, 9 deaths, or 0.19 of 1 per cent.

After 389 operations on the small intestine, 1 death, or 0.26 of 1 per cent.

After 9,908 operations on the appendix, 4 deaths, or 0.04 of 1 per cent.

After 2,530 operations on the colon and rectum, 5 deaths, or 0.20 of 1 per cent.

After 4,501 operations on hernia, 5 deaths, or 0.11 of 1 per cent.

After 900 operations on the kidney, 1 death, or 0.11 of 1 per cent.

After 601 operations on the prostate, 4 deaths, or 0.66 of 1 per cent.

After 7,993 operations on the uterus, tubes, and ovaries, 10 deaths, or 0.13 of 1 per cent.

Total, 40,449 operations, 47 deaths average 0.12 of 1 per cent.

No fatality from embolism occurred in any of the 1,346 operations on the breast, though a large share of these were extensive Halsted amputations. Neither did any fatal embolism follow any of the 449 vaginal hysterectomies, though there was one case in every 342 abdominal hysterectomies, that is, 5 in 1,712 cases.

The following are some of the salient facts shown in Table II:

Twenty-six of our patients were males and 21 females. The youngest was 25 years of age, the oldest 72, and the remaining cases were quite evenly distributed throughout the intervening decades.

Forty-one of the patients—all except 4 of the hernia cases and 2 of the appendix cases—had been from 2 to 35 years subject to some form of severe chronic debilitating disease. Speaking broadly, all these were very sick patients when operated upon, and, in the light of our present knowledge, the majority of them were probably the subjects of low-grade bacteræmias.

Nineteen of the fatalities occurred within the first week after operation, 21 more within the second week, 4 in the third week, and 1 each on the 26th, the 30th, and the 64th days, respectively. These latter three patients had all left the hospital and were well along in convalescence. In general, in marked contrast to the serious pre-operative conditions of these patients, it was noted that they were getting along remarkably well just prior to the occurrence of the fatal embolism. These patients, however, were not kept in bed either a materially greater or a materially less time than were other patients having the same type of operation.

In 36 of our cases the embolism was pulmonary, in 10 cerebral, and in 1 coronary. In 28 of the 41 cases posted the location of the originating thrombus was found in the field of operation or femoral vein. In 4 cases the emboli were found to have originated, in all probability, in the heart, and in the remaining 9 cases the source was undetermined. Arteriosclerosis was found in 5 cases, chronic myocarditis in 11, chronic nephritis in 14, and chronic hepatitis in 18. In 5 of the cases thorough post-mortem examination failed to show any considerable change in any tissue or organ except those incident to the healing of the wound and to the embolus itself.

#### SPECIAL INFERENCES FROM ABOVE CASES.

With this data before us, what inferences may be drawn therefrom? Why for the first ten years in the history of

the hospital, during which time 6,000 major operations were performed, were there no recognized deaths from embolism, while since that period one case in every 1,213 so terminated? Neither the surgeons, the anæsthetists, nor head nurses have been materially changed on the staff in that time, nor yet has their method of procedure been materially varied. The anæsthetic has been ether since the foundation of the hospital, and always it has been given in the smallest amount possible to maintain anæsthesia for only sufficient time to permit the rapid completion of the operation.

The only changes coincident with the increase are:

(a) In the nature of the operations. During the first ten years the number of operations on the stomach, gall-bladder, lower bowel and prostate, and of hysterectomies was small enough to come under the limit of probable fatality as measured by that of subsequent years. During the last twelve years a very high percentage of our operations has been on these organs, and it is subsequent to operations on these organs that most of our fatalities have occurred.

(b) The condition of the patient coming into the hospital and to the operating table has materially changed since the first decade of the hospital's history. During the first ten years of the clinic a very large proportion of the surgical cases were drawn from the general family practice of the members of the hospital staff and were operated on before they were *in extremis*. During the last twelve years, however, the surgical material has consisted almost entirely of referred cases, with an ever-increasing percentage of those of the "last resort" type, and it is in this class of cases in which most of the emboli have occurred.

#### GENERAL CONSIDERATIONS.

From a study of our own cases and of the literature of other observers, I desire to call attention to the following brief general considerations concerning the subject of post-operative embolism:

1. Following operations, particularly on the blood-vessels,

alimentary canal, and genito-urinary organs (both male and female), from 1 to 2 per cent. of all cases give more or less distinct clinical evidence of emboli, above 70 per cent. of which are in the lungs. Our own data in this regard have not yet been accurately tabulated, but they do not seem to give as high percentages as that from other clinics.

2. As nearly as can be observed from the incomplete and necessarily inaccurate data at hand, about 10 per cent. of post-operative emboli which give clinical symptoms of diagnostic significance cause sudden death.

3. Where post mortems are made on cases of fatal post-operative embolism, the source of the emboli can be definitely determined as venous thrombosis in about 80 per cent. of the cases, as cardiac thrombosis in 10 per cent. of the cases, while 10 per cent. are scattering or undeterminable.

4. Though there must be more or less formation of venous thrombi at the site of every extensive surgical operation, yet it is probable that the long, loosely-formed thrombi from medium-sized veins are those chiefly concerned in embolism, and especially in fatal embolism.

5. When large, loose thrombi are once formed in a resting patient, any unusual exertion or change of position may cause a dislocation of large masses which become dangerous emboli.

6. The most important factors concerned in extensive post-operative thrombosis are as follows:

(a) *Injury of the Vascular Walls.*—Rupture of the intima by cutting, ligating, or clamping causes a rapid deposit of a fibrinous thrombus, which, however, is normally confined to an area close to the injury. Over this the endothelium quickly extends, covering the thrombus within a few days. It is probable that such small terminal thrombi, when endothelial-covered, rarely, if ever, become dislocated and form emboli. There can be no question, however, but that the constantly-present small thrombi in injured vessels form a nidus for the subsequent development of large, loose thrombi through the activity of other factors.

(b) *Slowing and Stagnation of the Blood Stream.*—After

operations the rapidity and volume of the current in the veins are materially lessened for a considerable distance proximal to the first incoming venous radicles. Furthermore, the patient is usually kept quiet in a recumbent posture, thus reducing the force and rapidity of the heart's action and causing a general slowing of the blood current throughout the entire vascular system, including the heart. When the blood stream is slower or when a part of the vascular system is incompletely filled, a disarrangement of the blood-cells occurs, the white cells and platelets reaching the periphery of the stream and tending to attach themselves to the vascular walls. In addition to this, in the presence of obstacles or marked expansions, a whirling motion, as pointed out by von Recklinghausen, may be set up which further tends to the retardation of the blood stream and to the deposition of its elements as thrombi.

(c) *Disintegration of the Corpuscles of the Blood from Toxic Substances.*—While such toxic substances are not definitely known, their presence is assumed from their apparent action in the severe secondary anæmias and hepatic diseases. It has been suggested that this factor may account for the high percentage of post-operative emboli following operations on the gall-bladder. It has also been suggested that toxic substances reaching the circulation from extensive carcinomas may in this manner cause marked post-operative thrombosis. In this connection, however, we must not forget the rarity of post-operative emboli following extensive operations for mammary carcinomas.

(d) *Bacteræmia.*—That bacteria and their toxins are the chief causes of extensive post-operative thrombosis, as well as thrombosis occurring in the course of infectious diseases, is now fairly well established. By no means all post-operative thrombi occur in the field of operation. Phlebitis and a resulting thrombus are all too frequent. The last decade has seen a very marked extension of our knowledge of the frequent infection of the blood stream by bacteria. This is particularly so in chronic diseases with local infection. It is readily conceivable that bacteria within the blood stream may have their virulence

sufficiently reduced to prevent their setting up a local phlebitis until aided by operative traumatism of the intima, post-operative slowing of the blood current, or, perhaps, even the effect on the leucocytes of a prolonged general anæsthetic. Certain it is that many thrombi, which we were formerly wont to regard as "marantic," we have now come to know are of infective origin. In this connection the post-operative formation of cardiac thrombi (and therefrom pulmonary or cerebral emboli) on small areas of endocarditis is worthy of note. When a polypoid thrombus has been swept off from the wall of the heart its remaining ragged base may be overlooked without the most careful search at autopsy. While emboli from such a source are by no means common, the possibility of their occurrence must not be forgotten.

7. The above-mentioned factors must determine whatever precautionary measures may be taken for the prevention of post-operative thrombosis and embolism. The following suggest themselves:

(a) *The reduction of vascular traumatism to a minimum* at operation by the conservative occlusion of vessels, and the provision of free drainage to prevent later extensive external pressure on vessels.

(b) *The encouragement of very early free movement on the part of the patient* as soon as the nature of the operation and danger from hemorrhage will permit, though it must be confessed that the reported results from various clinics of "getting the patient up early" are unconvincing as to the reduction of post-operative embolism. If it can be done early enough to *prevent* the formation of extensive thrombi, it would seem to be most desirable. If, on the other hand, the condition of the patient's blood, either from anæmia or bacteræmia, is such as to lead to the suspicion that extensive thrombi *may have already been formed* before it is possible to permit free movement on the part of the patient, it would then seem the part of wisdom to keep the patient as quietly as possible in a recumbent position to prevent the dislocation of the already formed thrombi. All of the surgeon's judgment may be



TABLE I, SHOWING TOTAL OPERATIONS, DEATHS, ETC., COMPARED WITH DEATHS FROM EMBOLISM, ST. MARY'S HOSPITAL. SEPT. 30, 1889, TO JAN. 1, 1912.

Region	1889 to 1893		1894		1895		1896		1897		1898		1899		1900		1901		1902		1903		1904		1905		1906		1907		1908		1909		1910		1911		Totals	
	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.	Operations	Deaths from Embolism.		
Vessels.....	11	..	..	..	2	..	5	..	22	..	22	..	43	..	57	..	61	..	65	..	70	..	87	..	80	..	132	..	129	..	131	1	164	..	159	..	132	1	1372	2
Thorax and lungs.....	..	..	1	..	10	..	1	..	4	..	13	..	12	..	12	..	15	..	16	..	14	..	26	..	21	..	28	..	31	..	36	..	35	..	50	..	52	..	377	..
Thyroid.....	..	..	..	..	..	..	3	..	6	..	4	..	..	..	10	..	3	..	18	..	34	..	31	..	36	..	135	..	247	1	439	..	551	1	702	..	1047	..	3266	2
Mouth.....	38	..	5	..	18	..	25	..	34	..	38	..	20	..	30	..	24	..	36	..	33	..	95	..	147	..	138	..	234	..	252	..	318	..	428	..	358	1	2281	1
Stomach and duodenum..	9	..	2	..	1	..	4	..	11	..	12	..	16	..	26	..	59	..	77	..	139	..	171	..	217	..	214	1	190	..	232	..	272	..	336	1	403	1	2391	3
Gall-bladder and liver...	9	..	3	..	10	..	21	..	15	..	20	..	33	..	76	..	107	..	149	..	217	1	308	2	329	..	385	..	444	1	528	2	589	2	654	1	700	..	4597	9
Small intestine.....	2	..	..	..	7	..	5	..	2	..	4	..	10	..	7	..	14	..	15	..	21	..	18	..	7	..	11	..	35	..	27	..	38	..	67	1	99	..	389	1
Appendix.....	9	..	10	..	11	..	24	..	43	..	50	..	96	..	183	..	303	1	345	..	404	..	536	..	766	1	928	..	1151	..	1344	..	1334	..	1174	1	1197	1	9908	4
Colon and rectum.....	21	..	46	..	34	..	41	..	62	..	69	..	82	..	90	..	101	..	119	..	97	..	118	..	142	..	196	..	214	2	238	1	260	1	269	1	331	..	2530	5
Hernia.....	9	..	6	..	17	..	32	..	42	..	43	..	76	..	74	..	128	..	150	..	172	..	206	1	294	..	420	1	556	1	636	2	524	..	594	..	522	..	4501	5
Kidney.....	4	..	5	..	11	..	9	..	12	..	16	..	22	..	22	..	26	..	34	..	35	..	37	..	50	..	73	..	76	1	85	..	107	..	132	..	144	..	900	1
Urinary bladder.....	5	..	2	..	4	..	1	..	5	..	5	..	9	..	9	..	4	..	16	..	13	..	9	..	29	..	46	..	17	..	32	..	41	..	46	..	66	..	359	..
Prostate.....	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	6	..	29	..	27	..	63	..	42	..	67	1	86	..	82	..	87	2	111	1	601	4
Breast.....	18	..	8	..	11	..	14	..	11	..	16	..	28	..	35	..	36	..	41	..	37	..	48	..	84	..	98	..	102	..	148	..	202	..	212	..	197	..	1346	..
Uterus, tubes and ovaries.	58	..	73	..	34	..	112	..	179	..	156	..	303	1	312	..	324	1	287	..	360	..	454	1	514	..	720	..	755	2	663	..	806	..	967	2	916	3	7993	10
Totals .....	193	..	161	..	170	..	298	..	448	..	468	..	750	1	943	..	1205	2	1374	..	1675	1	2171	4	2779	1	3566	2	4248	9	4877	6	5323	4	5877	9	6275	8	42811	47
Abdominal hysterectomy.	5	..	4	..	13	..	12	..	15	..	31	..	39	..	34	..	31	1	51	..	58	..	79	1	97	..	130	..	175	..	173	..	240	..	257	2	268	1	1712	5
Vaginal hysterectomy....	..	..	..	..	..	..	14	..	8	..	9	..	12	..	17	..	13	..	11	..	17	..	7	..	30	..	49	..	58	..	51	..	41	..	57	..	55	..	449	..
Total abdominal operations	86	..	57	..	111	..	196	..	251	..	322	..	470	..	612	..	841	..	1074	..	1302	..	1788	..	2157	..	2750	..	3215	..	3647	..	5079	..	3990	..	4266	..	32174	..
Total operations.....	1075	..	537	..	606	..	877	..	783	..	973	..	1644	..	1713	..	2124	..	2420	..	2640	..	3131	..	3836	..	4770	..	5553	..	6451	..	7177	..	8218	..	8745	..	63573	..
Total deaths.....	15	..	1	..	5	..	6	..	10	..	12	..	13	..	21	..	27	..	32	..	69	..	62	..	64	..	69	..	81	..	86	..	83	..	108	..	100	..	864	..

TABLE 2.—CASES OF FATAL POST-OPERATIVE EMBOLISM, ST. MARY'S HOSPITAL, SEPTEMBER 30, 1889, TO JANUARY 1, 1912.

Office No.	Hospital No.	Name.	Sex	Age	Civil state.	Time sick.	Urine.	Operation.	Date	Significant post-operative symptoms.	Date of death.	Days after operation.	Clinical cause of death.	Autopsy cause of death.	Total operations from region.	Total deaths from embolism.	Percentage of cases.
<b>OPERATIONS ON VESSELS.</b>																	
A 3876	24381	J. B.	M	58	Wid.	.....	Neg.	Ligation subclavian artery for aneurism.....	1-4-1908	.....	1-6-1908	2	Embolism.....	Cerebral embolism...	.....	..	....
A 56079	.....	F. T.	M	54	Wid.	15 yrs.	Neg.	Phlebectomy. Varicose veins left leg.....	7-20-1911	Normal temperature and pulse after 6 days.	7-29-1911	9	Embolism.....	Pulmonary embolism.	1372	2	0.14
<b>OPERATIONS ON THYROID.</b>																	
A 776	23048	C. O. S.	F	37	Mar.	16 yrs.	Neg.	Thyroidectomy, exophthalmic goitre.....	8-21-1907	Pulse before operation 140.....	8-25-1907	4	Cerebral embolism...	Cerebral embolism...	.....	..	....
29528	.....	R. B. W.	M	55	Mar.	25 yrs.	Neg.	Thyroidectomy, enucleation multiple cysts of left lobe of thyroid.	10-4-1909	.....	10-5-1909	1	Pulmonary embolism.	Pulmonary embolism.	3266	2	0.06
<b>OPERATIONS ON MOUTH.</b>																	
A 50247	39894	G. P.	M	67	Mar.	5 mo.	Neg.	Excision cervical glands and anterior jugular veins for carcinoma tongue.	3-15-1911	Temperature 98 to 99 first 5 days. Pulse 80, 100, 90 to 125.	3-20-1911	6	Pulmonary embolism.	Embolism pulmonary artery.	2281	1	0.05
<b>OPERATIONS ON STOMACH.</b>																	
A 18974	.....	B. B.	M	41	Mar.	20 yrs.	Neg.	Gastro-enterostomy large ulcer duodenum. Secondary appendectomy.	10-13-1910	Temp. 103.5 on fourth day; normal eighth. Pulse 140, 4th, 95 on 7th.	10-23-1910	10	Pulmonary embolism.	Autopsy refused.....	.....	..	....
7968	.....	M. G. M.	M	66	Mar.	8 mo.	Neg.	Gastro-enterostomy chronic perforating ulcers of duodenum.	9-12-1906	.....	9-13-1906	1	Pulmonary embolism.	Embolism coronary artery.	.....	..	....
50487	.....	M. R.	M	47	Mar.	1 yr.	Albumen.	Exploration stomach for carcinoma (inoperable).	3-15-1911	No significant till sudden death.....	3-26-1911	12	Pulmonary embolism.	Autopsy refused.....	2391	3	0.12
<b>OPERATIONS ON LIVER AND GALL-BLADDER.</b>																	
2180	.....	W. T. B.	M	48	Mar.	27 yrs.	Neg.	Cholecystostomy. Secondary appendectomy.....	6-23-1907	No significant.....	7-12-1907	10	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 9932	26036	G. G.	F	36	Single	6-8 yrs.	Neg.	Cholecystostomy, cholecystectomy, fibroid uterus.	5-27-1908	No significant till sudden death.....	6-4-1908	8	Pulmonary embolism.	Autopsy refused.....	.....	..	....
1545	.....	W. H. L.	F	30	Mar.	Several yrs	.....	Cholecystostomy, stones in gall-bladder.....	8-8-1904	None till sudden death.....	8-23-1904	15	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
1368 G.	.....	B. S.	F	..	Single	3 yrs.	Neg.	Cholecystostomy, gall-stones, 10 stones in gall-bladder.	6-4-1903	None till sudden death.....	6-9-1903	5	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 20890	29499	H. T.	F	57	Mar.	9 to 10 yr.	Neg.	Cholecystostomy, stones in G. B., 3 in cystic duct.	3-16-1909	None till sudden death.....	3-25-1909	9	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 7738	25259	H. T.	F	35	Mar.	5 yrs.	Neg.	Cholecystostomy, one large stone in gall-bladder.	3-13-1908	None till sudden death.....	3-29-1908	8	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 46474	38394	J. W.	F	43	Mar.	12 yrs.	Neg.	Cholecystostomy, stones in G. B., cystic duct cut.	12-8-1910	Temperature 98.6 to 100 (2nd to 11th day). Pulse 70 to 85.	12-18-1910	12	Embolism.....	Double pulmonary embolism.	.....	..	....
1127	.....	C. E. W.	F	33	Mar.	6 yrs.	Neg.	Gall-bladder.....	6-20-1904	None till sudden death.....	7-3-1904	14	Embolism.....	Cerebral embolism...	.....	..	....
A 3064	.....	E. Z.	M	60	Mar.	35 yrs.	Trace alb.	Cholecystostomy, many stones in gall-bladder.	11-15-1907	None till sudden death.....	11-23-1907	8	Pulmonary embolism.	Autopsy refused.....	4597	9	0.19
<b>OPERATIONS ON SMALL INTESTINE.</b>																	
A 38550	35711	J. F. H.	M	57	Mar.	3 yrs.	Neg.	Amputation diverticulum.....	6-14-1910	.....	6-14-1910	..	Cerebral embolism...	Cerebral embolism...	389	1	0.26
<b>OPERATIONS ON APPENDIX.</b>																	
958J	.....	W. P.	M	25	Single	1 wk.	Neg.	Large appendiceal abscess with stone, 8 day, draining.	11-1-1905	Peritonitis.....	11-6-1905	5	Peritonitis.....	Pulmonary embolism.	.....	..	....
A 41747	.....	H. S.	M	35	Mar.	2 yrs.	Neg.	Drain of abscess. Appendix not removed.....	8-12-1910	Temp. 103 to 99 on 2nd day, 99 and 100 3rd day. Pulse 120-100.	8-14-1910	2	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
.....	.....	W. S.	M	31	Mar.	2 yrs.	Neg.	Appendectomy. Acute appendicitis.....	1-10-1901	None till sudden death.....	1-18-1901	8	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
58714	.....	G. E. V. A.	M	30	Mar.	2 da.	Neg.	Acute appendicitis.....	9-12-1911	Normal 3rd to 8th days, then normal or subnormal. Pulse 60 after 2nd.	9-20-1911	8	Pulmonary embolism.	Pulmonary embolism.	9908	4	0.04
<b>OPERATIONS ON COLON AND RECTUM.</b>																	
9663 G.	.....	R. D.	F	29	Single	10 or 12 yrs.	Neg.	Kraske for cancer rectum. 5 inches intestine removed.	4-27-1907	No significant till sudden death.....	5-13-1907	17	Pulmonary embolism.	Pulmonary and cardiac embolism.	.....	..	....
37495	35351	M. D.	M	..	.....	2 yrs.	Neg.	Carcinoma rectum.....	5-19-1910	Early in convalescence peritonitis.....	6-18-1910	30	Cerebral embolism...	Cerebral embolism...	.....	..	....
A 13039	30438	J. J.	M	58	.....	2 yrs.	Neg.	Resection of sigmoid.....	5-26-1909	.....	5-27-1909	1	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 14506	27300	H. L. L.	M	52	Mar.	6 mo.	Neg.	Resection splenic flexure, lateral anastomosis.....	9-11-1908	None till sudden death.....	9-19-1908	8	Cerebral embolism...	Cerebral embolism...	2530	5	0.20
<b>OPERATIONS ON HERNIAE.</b>																	
A 1396	29532	B. L. A.	F	38	Mar.	11 yrs.	Neg.	Cholecystostomy, umbilical hernia, herniotomy.	3-17-1909	Temp. after 2 wks. 102 to 100, then 103 to 104. Pulse after 2 wks. 110, 100 to 120.	4-5-1909	19	Cerebral embolism...	Cerebral and pulmonary embolism.	.....	..	....
A 7855	25269	H. B.	M	37	Mar.	1 yr.	Neg.	Right inguinal direct hernia, herniotomy.....	3-23-1908	None till sudden death.....	5-1-1908	9	?	Pulmonary embolism.	.....	..	....
A 10617	26150	S. J.	M	57	Mar.	1 yr.	Neg.	Herniotomy, right inguinal hernia. Cord displaced.	6-6-1908	None till sudden death.....	6-9-1908	3	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
1209 M.	.....	W. K.	M	63	Mar.	2 yrs.	Neg.	Removed double cyst of epididymis. Double hydrocele and inguinal hernia.	7-20-1904	None till sudden death.....	7-27-1904	7	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
1379 J.	.....	L. K.	M	61	Mar.	8 yrs.	Neg.	Herniotomy, double inguinal hernia, large direct.	5-3-1906	None till sudden death.....	5-15-1906	12	Pulmonary embolism.	No autopsy.....	.....	..	....
3099	.....	J. W.	M	65	Mar.	12 yrs.	Neg.	Herniotomy, large, direct inguinal hernia.....	10-25-1907	Temp. 26th to 31st days 98, 99, 101, 99, 101, 99, 100, normal. Pulse always 84.	10-31-1907	6	Pulmonary embolism.	Pulmonary embolism.	4501	5	0.11
<b>OPERATIONS ON KIDNEY.</b>																	
A 9828	26184	C. D. M.	F	45	Mar.	13 yrs.	Neg.	Tumor right kidney, pyonephrosis.....	6-9-1908	None till sudden death.....	6-21-1908	12	Pulmonary embolism.	Pulmonary embolism.	900	1	0.11
<b>OPERATIONS ON PROSTATE.</b>																	
A 2803	23631	J. B.	M	25	.....	25 yrs.	Albumen.	Perineal prostatectomy for large prostate.....	10-21-1907	None till sudden death.....	10-22-1907	1	Cerebral embolism...	Shock or cerebral embolism.	.....	..	....
A 38191	.....	J. C. L.	M	65	Single	4 yrs.	Trace alb.	Suprapubic prostatectomy, hypertrophied prostate	4-15-1911	Temperature and pulse normal first 31 days	6-18-1911	64	Pulmonary embolism.	Right pulmonary embolism.	.....	..	....
A 35217	37529	P. M.	M	72	Mar.	20 yrs.	Some alb.	Suprapubic prostatectomy, catheter left in urethra.	10-12-1910	.....	10-14-1910	2	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 37447	35407	J. J. M.	M	66	Wid.	10 yrs.	Some alb.	Suprapubic prostatectomy, hypertrophied prostate	5-23-1910	None till sudden death.....	6-1-1910	10	Pulmonary embolism.	Pulmonary embolism.	601	4	0.66
<b>OPERATIONS ON UTERUS, TUBES, AND OVARIES.</b>																	
.....	.....	R. B. C.	F	42	Mar.	2 yrs.	Neg.	Supravaginal hysterectomy for fibroids.....	10-25-1901	.....	10-27-1901	3	Pulmonary embolism.	No autopsy.....	.....	..	....
3690 G.	.....	S. C.	F	51	Mar.	8 yrs.	Neg.	Repair of lacerated cervix.....	9-13-1899	None till sudden death.....	10-9-1899	26	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
37821	.....	E. A. C.	F	47	Mar.	2 yrs.	Albumen.	Hysterectomy for carcinoma of uterus.....	8-10-1904	None till sudden death.....	8-22-1904	12	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 35866	.....	J. G.	F	43	Mar.	7 wks.	Alb.+sugar	Total abdominal hysterectomy.....	5-25-1910	None till sudden death.....	6-1-1910	8	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
.....	.....	J. H.	F	45	Mar.	9 mo.	Neg.	Subtotal abdominal hysterectomy, left ovary and tube removed.	4-2-1910	101 5th day, 98.6 on 8th and 9th days. Pulse, 90 to 96 on 8th and 9th days, then 76 to 80.	4-10-1910	8	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 1451	23192	A. McK.	F	41	Mar.	10 mo.	Some alb.	Exploration of abdomen for carcinoma uterus.....	9-4-1907	None till sudden death.....	9-10-1907	6	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
48404	39237	P. E. R.	F	44	Mar.	3 yrs.	Neg.	Abdominal hysterectomy for degenerating fibroids.	2-3-1911	.....	2-5-1911	3	Cerebral embolism...	Cerebral embolism...	.....	..	....
9802 G.	.....	J. S.	F	50	Mar.	2 yrs.	Neg.	Laparotomy for removal of ovarian cyst.....	5-28-1907	None till sudden death.....	6-3-1907	6	Cerebral embolism...	Cerebral embolism...	.....	..	....
A 58996	42967	R. T.	F	29	Mar.	9 mo.	Neg.	Laparotomy for removal of right tube.....	9-26-1911	Temp. 101, 99 to 100. Pulse 90 to 100, as low as 70 3rd day.	10-3-1911	8	Pulmonary embolism.	Pulmonary embolism.	.....	..	....
A 53176	.....	M. W.	F	57	Wid.	6 mo.	Trace of albumen.	Watkins-Wertheim and phlebectomy. Varicose veins left leg.	5-23-1911	Temperature 98 to 100. Pulse from 80 to 90.	6-12-1911	20	Pulmonary embolism.	Right pulmonary embolism.	7993	10	0.13

needed, and even then be at fault, in thus steering between the Scylla and Charybdis of "getting the patient up early" or "letting him have a long rest in bed." Either may be the worse thing or the better thing for the patient according to whether extensive thrombi have or have not formed. So far as I know, we have not yet sufficient data on which to base an accurate estimate of the time required in a given case for the formation of extensive post-operative thrombi. We do know, however, that such large, loose thrombi, once formed, are readily dislocated by a relatively slight exertion on the part of the patient.

(c) *The pre-operative administration of drugs to increase the coagulability of the blood*, as, for example, calcium salts in hepatic disturbances, is of questionable value, so far as thrombosis and embolism are concerned. It has not yet been shown that the presence of calcium salts in the blood renders it less liable to form thromboses, though it may be true that their presence induces the formation of a more dense clot.

(d) *Measures looking toward the reduction of bacteremia* are certainly indicated as a pre-operative precaution for the prevention of thrombosis and embolism. Where possible, the preliminary destruction (as with a cautery) of local foci of infection should be considered. When the invading organism can be isolated and identified, a preliminary vaccination is suggested. Indeed, it is probable that in some instances such a preliminary vaccination might prove of material benefit to the patient in avoiding post-operative infections other than those of the vascular system.