THE RECORDING OF SURGICAL AND ANESTHETIC DATA IN TWO ARMY GENERAL HOSPITALS

The Adaptation of Hollerith Punch Cards, Used from July 1, 1941 to December 31, 1943 *

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Accurately recorded statistical studies serve as effective instructive forces to both surgeon and physician anesthetist. Statistics are of value in studying anesthetic agents, technics of administration, and complications only when the number of individual cases considered totals in the thousands. A uniform system of collecting data has been provided by the Committee on Records, of the American Society of Anesthetists. This system utilizes a standard code, a definite interpretation of the code (1), and a card which makes possible the rapid mechanical counting of specific items of interest. In 1940, an experiment was undertaken to determine the practicability of using a modified Hollerith punch card for the recording of surgical and anesthetic data in the medical department of the Army (2). The standard code card was modified by printing a commonly used graphic chart on the reverse side of the card. This modification makes possible the preserving of all the preoperative, operative and postoperative information concerning an individual patient on a single, compact, mechanically sortable card. No part of the recording requires individual inspection in order to compile a statistical report because this is mechanically accomplished at the rate of approximately 400 cards per minute by a sorting machine. After trying the method on a few cases, it was concluded that it was practical, that it possessed outstanding advantages for those trained in its use, and that it deserved further study.

During the past two and one half years, the authors, in their respective hospitals, have employed this system of record keeping, in addition to the sheet (Form 55 0–1) now required by the War Department. One hospital is situated on the Pacific Coast and the other is on the Atlantic Seaboard. After the significant information was recorded in code form on the card and the operation of punching completed, the cards were pooled for sorting by a machine, owned by the International Business Machines Corporation, called a Sorter. When this operation was completed a factual, accurate, statistical report was apparent.

It is the purpose of the authors to present a brief review of 4289 cases from the two hospitals, to illustrate the method of recording

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data, and the type and completeness of the information obtainable. When thousands of cases are involved, unless the punch card system is used, it is impossible to complete such a report without the expenditure of many, many hours of clerical work. It is fully appreciated that a study of a few thousand cases is not of statistical significance, and that no conclusions can be drawn from this report. However, it can serve to show the nature and complications of patients operated upon in these two hospitals. Attention is invited to the fact that if this system were employed by a large number of anesthetists during the present conflict, detailed information of statistical value would be obtainable.

METHOD

The card and code used is the one described by the Committee on Records of the American Society of Anesthetists in their publication *Interpretations to the Anesthesia Code* (1). The card has the usual anesthetist's graphic chart printed on the reverse side. This card has been previously described in detail (1 and 2) and is shown, before use, in its cellulose acetate holder (made from discarded x-ray film) in figure 1.

The purpose of the card holder is to prevent damage to the edges of the card during use in the operating pavilion and wards. The holders can be conveniently carried in a small loose leaf notebook. A damaged card jams and stops the sorting machine; however, once a card has been correctly punched, even though damaged, it can be mechanically reproduced by an Automatic Duplicating Punch. Even the numbers represented by punch holes can be transcribed mechanically on the top border of the card by a machine called an Interpreter. All of these machines are in daily use in the Service Bureau of the International Business Machines offices, located in most cities of this country.

When a patient is scheduled for operation a card is labeled with the proper name, rank, and location (room or ward) in the hospital. In the spaces on the front side of the card, labeled GEOG., an arbitrary number is placed which identifies a given hospital from another. When the operation is completed the sequential case number is written in the spaces opposite CASE NO. On lines 3 to 6, the pertinent preoperative information is recorded. During the operation, or immediately after, the proper code numbers concerning the operative procedure are added. Lines 13 and 14 are reserved for the recording of postoperative complications. The above use of the code has been previously described in detail (1), as well as the detailed use of the graphic chart (2). The next line, beginning ANESTH., is for the individual anesthetist's code number, and this also applies to the following line for the surgeon. If anesthetist and surgeon are recorded by a single digit code number, four columns remain on the card and these may be used to represent hospital treatment or special studies of interest to the surgical staff, using a privately devised code. When it becomes evident on postoperative rounds that a patient has recovered sufficiently so that further

complications are unlikely, the card is marked with a symbol, such as "ok" and is now ready for punching.

Punching may be done at any convenient time with an Electric Key Punch rented from the International Business Machines Corpora-

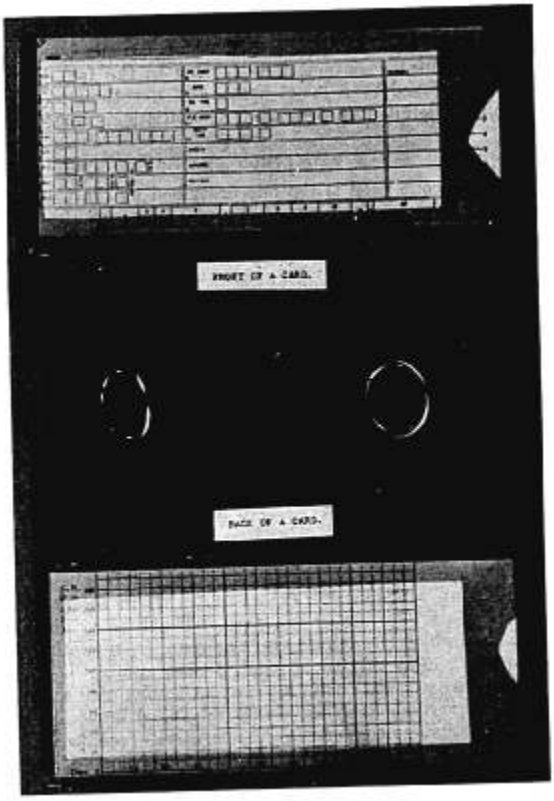

FIG. 1. Modified Hollerith punch card in holder.

tion or by personnel of the I.B.M. Service Bureau who are expert machine operators. Accuracy in coding is essential in order to produce a sortable group of cards. Sorting is entirely a technical procedure and is rapidly accomplished by the Service Bureau's machine operators. The information desired in order to answer statistical questions, of course, must be outlined by the surgeon or anesthetist desiring a report.

The individual sorts required depend on the information requested, and the nature and type of statistical questions to be answered. Some reports may be very elaborate and require complex, multiple sorts for detailed information. Others may only answer the more commonly asked questions, such as how frequently a given agent or technic was used.

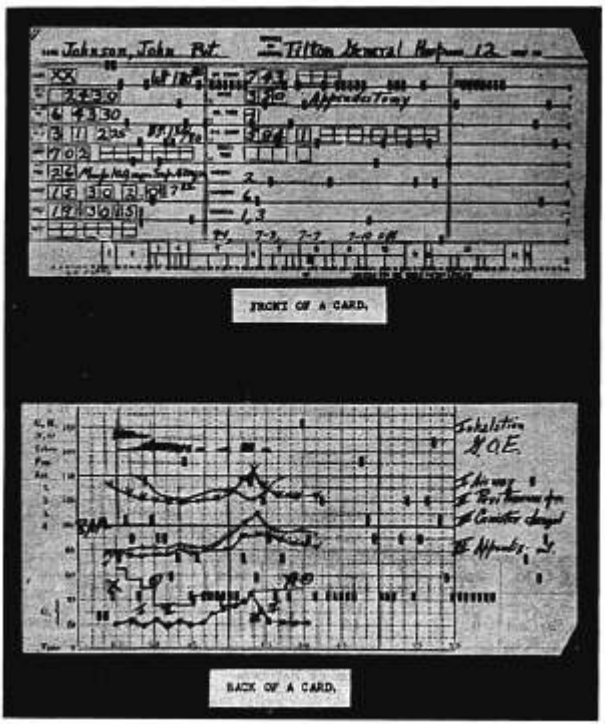

FIG. 2. Completed punched card ready for sorting.

The first nine columns of the card are not used by the American Society of Anesthetists' code and may be utilized to record information of local interest. For use in these columns an individual anesthetist or surgeon may make his own private code, recording any information desired. The code numbers for this purpose should be written opposite numbers one to nine on the extreme right end of the front side of the card. Figure 2 shows a completed card punched and ready for sorting.

STATISTICAL REPORT

The following detailed report is presented to demonstrate the type and completeness of the information obtainable from the above described record system, used in two General Hospitals of the Army. To conserve paper and space, some of the data incorporated in lengthy tables have been omitted from this publication and only their titles listed, as noted below.

Combinations of Anesthetic Agents
Principal Agent Used for Each Operation
Detailed Study by Region—Premedication
Age, Physical Status Preoperatively, Duration of Anesthesia, Level of Anesthesia, Month and Season
Time of Death—Operation—Morbid Conditions—Initiating Disease

GENERAL INFORMATION

Principal Anesthetic Agent		Per Cent of Total	Principal Technic of Administration		Per Cent of Total
Ether	1463	34.1	Inhalation (Non-endotracheal)	1848	43.1
Nitrous Oxide	420	9.7	Inhalation (Endotracheal)	311	7.2
Cyclopropane	257	6.0	* Rectal Instillations	0	0.0
Vinethene	19	0.4	Intravenous	491	11.5
Pentothal	482	11.1	Spinals	1297	30.3
Other Barbiturates	9	0.2	Sacral, Caudal or Both	101	2.4
Procaine	1053	24.5	Field Blocks	3	0.07
Metycaine	478	11.1	Infiltration	104	2.4
Pontocaine	89	2.6	Specific Nerve Blocks	134	3.1
Nupercaine	19	0.4			
Totals	4289		Totals	4289	

* Avertin was used 15 times but not as the principal agent. (Used only as basal.)

AGE OF PATIENTS

	No Data	1-9	10-19	20-29	30-39	40-49	50-59	60-69	Total
	22	22	186	2415	1347	207	80	10	4289
Incidence, Per Cent	0.5	0.1	4.3	56	31.4	4.8	1.8	0.2	

SEX OF PATIENTS

Males..... 4210 Females..... 79

PHYSICAL STATUS OF PATIENTS

	No Data	Good	Fair	Poor	Serious	Emergency		Moribund	Total
						Good	Poor		
	33	3679	278	46	13	200	35	5	4289
Incidence, Per Cent	0.7	85.9	6.4	1.1	0.3	4.6	0.8	0.01	

DETAILED STUDY BY REGION

PHYSICAL STATUS PREOPERATIVELY

Region	Good	Fair	Poor	Serious	Emergency		Moribund	No Data	Total
					Good	Poor			
No Operation	5				2				7
Head and Neck					Total for 000 group				
Head, Superficial	23		1		6				30
Intracranial	22	8	3	1	3	6	3	1	47
Neck	38	3	1		6	1			49
Thyroid and Parathyroid	72	7	2					2	83
Ear, Nose and Throat	118	3		1	4	2		3	131
Dental	11								11
Eye	82	2			3				87
Thorax					Total for 100 group				439
Superficial	23	6		1	3				33
Extrapleural Operations	28	14	1	1	2			1	47
Intrapleural Operations	8	11	4	2	3	1			29
Heart and Vessel Operations	1	1						1	3
Abdomen Intraperitoneal					Total for 200 group				115
Gallbladder and Ducts	33	2	1						36
Stomach and Duodenum	8	6	3	1	2	2		1	23
Deep Operations	4	6				2	1		13
Colon Operations	3	5	1						9
Miscellaneous, Upper Abdomen	32	4	3		2				41
Appendix and Diverticula	64	9	1		56	3		1	134
Intestinal, Abdominal Wall	26	13	8	2	3	8		1	61
Gynecologic	4								4
Miscellaneous, Lower Abdomen	16	4	1						21
Abdomen Extraperitoneal					Total for 300 group				342
Abdomen Extraperitoneal Lower	19	5	2		1			1	28
Abdomen Superficial	14	5			1				20
Inguinal	413	14		1	1			3	432
Lumbar	102	24	2			2	1	1	132
Perineum					Total for 400 group				612
Anorectal Operations	176	6	1		4			1	188
Genito-Urinary	346	21	1		6			3	377
Gynecologic	15	3			2				20
Obstetric	1								1
Extremities					Total for 500 group				586
Superficial	210	12	2		15	3		2	244
Tendons and Muscles	136	7			4			1	148
Joints	437	14	1		4			3	495
Bones	368	34	2	1	20	2		1	428
Amputations and Disarticulations	46	4	3		5	3			61
Application Cast, Manipulation	90	1			35				126
Vessel Operations	6	1	1	1					9
Nerve Operations	75	3						1	79
Others, Unclassifiable	3								3
Spinal Cord and Column					Total for 600 group				1593
Neurologic	61	6		1				2	70
Orthopedic	381	7			2			3	393
Therapeutic and Diagnostic					Total for 700 group				463
Therapeutic	58	6	1		3				64
Diagnostic	69	1			2				72
					Total for 800 group				136
Grand Totals	3679	278	46	13	200	35	5	33	4289
Per Cent of Total	85.9	6.4	1.1	0.3	4.6	0.8	0.01	0.7	

DETAILED STUDY OF AGENT ADMINISTERED

			Technics	
				126 Abs. Circ. Endotracheal
				7 Abs. Circ. Pos. Pressure
				2 Abs. Circ. Control Resp.
				692 Absorption in Circuit
			Circle Absorption	827 Total
				65 To and Fro Endotracheal
				3 To and Fro Pos. Pressure
				6 To and Fro Control Resp.
				97 Absorption To and Fro
			To and Fro Abs.	171 Total
				5 Semi-closed, Endotracheal
				4 Semi-closed
			Semiclosed	9 Total
				47 Open Drop Endotracheal
				396 Open Drop
				13 Pharyngeal Insufflation
			Open	456 Total
				2 Abs. Circ. Endotracheal
				5 Abs. Circ. Pos. Pressure
				259 Absorption in Circuit
			Circle Absorption	266 Total
				1 To and Fro Endotracheal
				39 Absorption To and Fro
			To and Fro Abs.	40 Total
			Semiclosed	80 Total
			Open	34 Pharyngeal Insufflation
				3 Abs. Circ. Endotracheal
				6 Absorption in Circuit
			Circle Absorption	9 Total
				46 To and Fro Endotracheal
				4 To and Fro Control. Resp.
				195 Absorption To and Fro
			To and Fro Abs.	245 Total
			Open	3 Insuffl. Pharyngeal Total
				19 Total
				201 Without Ephedrine Sulfate
				598 With Ephedrine Sulfate
				5 With other Adrenergic Drug
				30 Continuous Spinals
			Spinals	834 Total
			Sacral, Caudal, both	42 Total
			Field Blocks	2 Total
			Infiltration	137 Total
			Specific Nerve Block	38 Total
				151 Without Ephedrine Sulfate
				203 With Ephedrine Sulfate
				1 With other Adrenergic Drug
				1 Continuous Spinal
			Spinal	356 Total
			Sacral, Caudal, both	65 Total
			Field Block	2 Total
			Infiltration	6 Total
			Specific Nerve Block	49 Total
				26 Without Ephedrine Sulfate
				59 With Ephedrine Sulfate
				3 With other Adrenergic Drug
			Spinal	88 Total
			Others	1 Total
				6 Without Ephedrine Sulfate
				13 With Ephedrine Sulfate
				19 Total

Inhalation 2259 cases	Ether 1463 cases		
	Nitrous Oxide 420 cases		
	Cyclopropane 257 cases		
	Vinethene	19	Open
Intravenous 491 cases	Pentothal	482	cases
	Sombutal	8	cases
	Evipal	1	case
Blocks 1639 cases	Procaine 1053 cases		
	Metycaine 478 cases		
	Pontocaine 89 cases		
	Nupercaine 19 cases		

DETAILED STUDY OF AGENT ADMINISTERED
SPECIFIC NERVE BLOCKS

Procaine	Metycaine
7 Stellate Ganglion Blocks	5 Stellate Ganglion Blocks
2 Brachial Plexus Blocks	7 Brachial Plexus Blocks
7 Lumbar Sympathetic Blocks	28 Lumbar Sympathetic Blocks
2 Intercostal Nerve Blocks	6 Intercostal Nerve Blocks
1 Shoulder Nerve Block	1 Ulnar Nerve Block
7 Lumbar Nerve Block (1 Alcohol)	1 Lumbar Nerve Block
3 Thoracolumbar Nerve Blocks	1 Anterior and Posterior Tibial N.B.
2 Cervical Paravertebral Blocks	
7 Miscellaneous Nerve Blocks	
38 Total	49 Total

SPINAL ANESTHESIA SUPPLEMENTED

	Administrations	Supplemented	Unsupplemented
Procaine spinals	834	95	739
Metycaine spinals	356	27	329
Pontocaine spinals	88	18	70
Nupercaine spinals	19	4	15
Total spinals	1297	144	1153
Per Cent		11	89

DURATION OF ANESTHESIA

Agent	No Data	5 Min.	½ Hr.	1 Hr.	1½ Hr.	2 Hrs.	3 Hrs.	4 Hrs.	5 Hrs.	6 Hrs.	Total
Ether	5	2	75	388	390	383	203	81	27	9	1463
Nitrous Oxide		11	185	132	51	29	10	2			420
Cyclopropane		2	40	46	55	54	53	6	1		257
Vinethene		2	17								19
Pentothal		33	295	93	24	17	14	5	1		482
Other Barbiturates			9								9
Procaine	2	4	171	584	175	68	30	14	5		1053
Metycaine			60	172	132	65	43	6			478
Pontocaine			2	24	20	30	11	2			89
Nupercaine					8	7	4				19
Total	7	54	854	1439	855	553	368	116	34	9	4289
Per Cent	0.1	1.3	19.9	33.6	19.9	12.9	8.6	2.7	0.8	0.1	

INCIDENCE OF PREOPERATIVE COMPLICATIONS

3077 Patients without any complication before operation
1212 Patients with one or more complications before operation

Circulatory System — Total 103
- 1 Aneurysm, Aortic
- 1 Aneurysm, Misc.
- 3 Arterioscl. Gen.
- 9 Phlebitis
- 5 Other Vas. Dis.
- 1 Endart. Obliterans
- 3 Funct. Capacity 1
- 1 Funct. Capacity 11
- 8 Ht. Dis. Thyrotoxic
- 1 Accid. Div. Imp't Bl. Vessel
- 6 Ht. Dis. Rheumatic
- 6 Ht. Dis. A-Scler. and Hyperten.
- 4 Ht. Dis. Luetic
- 1 Myocard. Degeneration
- 2 Heart Block
- 3 Aur. Fibrillation
- 5 Other Arrhythmia
- 9 Hemorrhage, Moderate
- 5 Hemorrhage, Severe
- 8 Tachycardia
- 1 Bradycardia
- 7 Hypertension
- 4 Hypotension
- 1 Shock Traumatic
- 2 Bl. P. Rise Marked
- 1 Ht. Dis. Coronary
- 2 Pul. Embolus
- 1 Ascites
- 4 Others, Ht. Dis.

Central Nervous System — Total 105
- 7 Apprehension Marked
- 1 Excitement Marked
- 12 Neurosis
- 1 Epilepsy
- 36 Psychosis
- 1 Meningitis
- 4 Increased Intracran. Pres.
- 6 Concussion
- 5 Skull Fracture
- 1 C.N.S. Lues
- 1 Myelitis, Transverse
- 1 Meningeal Hemorrhage
- 1 Encephalitis
- 1 Brain Abscess
- 20 Headache
- 3 Paralysis
- 1 Backache
- 2 Headache Post. Lum. Punc.

Genitourinary System — Total 55
- 2 Anuria
- 1 Azotemia
- 4 Low Kidney Function
- 5 Pyelitis, Pyelonephr.
- 3 Pyelitis, Pyelonephr. TBC
- 9 Cystitis
- 4 Hematuria
- 1 Hypernephroma
- 4 Epidid., Orchitis
- 3 Prostatitis
- 9 Albuminuria
- 21 Hydronephrosis
- 4 Reten. Obstr. Moder.
- 5 Reten. Obstr. Severe
- 2 Ruptured Bladder
- 1 Chronic Nephritis

Blood, Drug and Technical — Total 461
- 1 Leukemia
- 1 Bl. Dyscrasia, Others
- 1 Hemolytic Jaundice
- 2 Splenomegaly
- 1 Agranulocytosis
- 8 Syphilis
- 57 Secondary Anemia Mod.
- 7 Secondary Anemia Severe
- 69 Leukocytosis
- 5 Idiosyncrasy to Drugs
- 309 Previous Operation

Gastrointestinal System — Total 121
- 3 Perforated Peptic Ulc.
- 4 Peptic Ulc. (not Perf.)
- 1 Evisceration Intest.
- 1 Peritonitis Diffuse
- 4 Intest. Obst. Compl., Early
- 3 Intest. Obst. Compl. Late
- 3 Other Lower Obst.
- 3 Choledocholithiasis
- 1 Hepatitis
- 4 Colitis
- 1 Gastritis
- 1 Diverticulitis
- 1 Pancreatitis
- 6 Nausea and Emesis
- 10 Jaundice, Slight
- 2 Jaundice, Severe
- 66 Acute Appendicitis
- 1 Paralytic Ileus
- 4 Distention, Mod.
- 2 Distention, Severe

INCIDENCE OF PREOPERATIVE COMPLICATIONS—*Continued*

Infections		Total	114
1 Furuncle	6 Cold Abscess		
1 Subphrenic Abscess	5 Toxemia		
72 Wound Inf. Moderate	16 Chronic Osteomyelitis		
9 Wound Inf. Severe	1 Otitis Media, Chr.		
1 Cellulitis	2 Other Abscesses		
Respiratory		Total	395
27 Upper Resp. Infec. Ac.	21 Emphysema		
137 Upper Resp. Infec. Recent	13 Lung Abscess		
46 Upper Resp. Infec. Chronic	26 Hist. of Pneumonia		
26 Cough	4 Other Mechanical Disturbance		
12 Pharyngitis	22 Empyema		
3 Bronchiectasis	12 Pleural Effusion		
6 Rales at Bases	7 Broncho-Pleu. Fist.		
12 Bronchitis, Chronic	2 Broncho-Cut. Fist.		
4 Bronchial Asthma	9 Pul. TBC. Quiescent		
2 Tracheal Compression	4 Pul. TBC. Active		
Metabolic and Endocrine		Total	80
20 Weight loss Marked	2 Malignancy Prostate		
5 Obesity, Marked	2 Malignancy Eye		
15 Hyperthyroidism, Mod.	1 Malignancy Skin		
3 Hyperthyroidism, Sec.	3 Malignancy Stomach		
1 Malignancy Esophagus	4 Malignancy Colon		
1 Malignancy Mouth	4 Malignancy Sigmoid		
1 Malignancy Breast	6 Malignancy Rectum		
4 Endocrine Dysfunction	1 Malignancy Brain		
4 Malignancy Kidney	1 Malignancy Pancreas		
2 Malignancy Bladder			
Grand Total	Complications (not patients)		1458

INCIDENCE OF COMPLICATION DURING OPERATION

3353 Patients without any complications during operation
936 Patients with one or more complications during operation

Circulatory System		Total	168
1 case of Pulmonary Embolus	2 cases of Hypotension		
28 cases of Arrhythmia	10 cases of Hemorrhage, Moderate		
10 cases of Shock, Anesthetic	5 cases of Hemorrhage, Severe		
29 cases of Shock, Traumatic	63 cases of B.P. Fall, Not Shock		
1 case of Fibrillation, Aur.	11 cases of B.P. Rise, Marked		
2 cases of Bradycardia	1 case of Hypertension.		
2 cases of Tachycardia	1 case Accid. Div. Imp't Bl. Vessel		
2 cases of Others, Misc.			
Central Nervous System		Total	66
9 cases of Apprehension, Marked	16 case of Tremor Under Anesthesia		
30 cases of Excitement, Marked	1 case of Muscle Twitching		
1 case Irrational	1 case of Paresthesia		
1 case of Others, Mental	1 case of Pain		
6 cases of Convulsions			
Drug and Technical		Total	201
4 cases of Overdose Anesthetic	11 cases of Difficult Spinal Tap		
18 cases of Insuff. Premedication	11 cases of Poor Functioning Apparatus		
6 cases of Idiosyncrasy to Drug	2 cases of Accid. Extravenous Injection		
3 cases of Overdose of Premed. Drug	2 cases of Impotent Drug		
12 cases of Anesthetic Failure	1 Op. Limited Acc't Anesthesia		
84 cases of Insufficient Relax., Pain	3 cases of Trauma to Teeth		
1 Op. Limited Acc't Anes. Method	20 cases of Trauma to Lip		
2 Ops. Limited Acc't Patients Con.	3 cases of Trauma to Larynx		
7 Difficult Intubation, Not Traum.	1 case of Trauma to Pharynx		
3 Traumatic Intub., Not Completed	4 cases of Trauma to Eye		
4 cases of Epistaxis	1 case of Other Limitations		

INCIDENCE OF COMPLICATION DURING OPERATION—*Continued*

	Total	266
Gastrointestinal		
64 cases of Nausea	37 cases of N & E during Recovery in O.R.	
28 cases of Nausea and Emesis	2 cases of Retching	
35 cases of N & E during Induct.		
	Total	140
Respiratory		
11 cases of Coughing	5 cases of Apnea, Marked	
10 cases of Pharyngeal Obstruction	15 cases of Respiratory Depression	
2 cases of Cord Paralysis	6 cases of Asphyxia	
249 cases of Laryngospasm, Moderate	71 cases of Carbon Dioxide Excess	
27 cases of Laryngospasm, Severe	36 cases of Excess Mucus	
6 cases of Other Upper Resp. Obst.	13 cases of Hiccup	
1 case of Accid. Pneumothorax	3 Others, Misc. Respiratory	
2 cases of Intercostal Paralysis		
1 case of Tracheal Collapse		
1 case of Other Mechanical Dist.		
1 case of Bronchial Asthma		
1 case of Lower Bronchial Obst.		
38 cases of Oxygen Want, Moderate		
11 cases of Oxygen Want, Severe		
	Total	2
Obstetrical		
1 case of Baby Premature	1 case of Other Hemorrhage	
Grand Total	Complications (not Patients)	1413

INCIDENCE OF POSTOPERATIVE COMPLICATIONS

2351 Patients without any complications after operation
1938 Patients with one or more complications after operation

	Total	73
Circulatory System		
4 cases of Pulmonary Embolus	14 cases of Tachycardia	
1 case of Aneurysm, Misc.	1 case of Bradycardia	
1 case of Fibrillation, Aur.	1 case of Circulatory Failure	
4 cases of Other Arrhythmia	27 cases of Hemorrhage, Mod.	
1 case of Phlebitis	7 cases of Hemorrhage, severe	
8 cases of Shock, Traumatic	1 case of Hypertension	
3 cases of Shock, Anesthetic		
	Total	61
Central Nervous System		
21 cases of Excitement, Marked	2 cases of Increased Intracran. Pre.	
12 cases Irrational	2 cases of Convulsions	
6 cases of Psychosis	3 cases of Muscle Twitching	
2 cases of Neurosis	1 case of Paresthesia	
7 cases of Others, Mental	69 cases of Headache	
109 Headache, Post-Lumb. Punct.		
27 Backache, Post-Lumb. Punct.		
	Total	222
Genito-Urinary System		
244 cases of Single Catheterizations	3 cases of Hematuria	
65 cases of Multiple Catheterizations	1 case of Glycosuria	
1 case of Oliguria	1 case of Urethritis	
1 case of Incontinence	1 case of Albuminuria	
4 cases of Cystitis	1 case of Pyelitis, Pyelonephr.	
	Total	9
Blood, Drug and Technical		
4 cases of Anemia, Secondary	2 cases of Idiosyncrasy to Drug	
2 cases of Transfusion Reactions	1 case of Epistaxis	
	Total	957
Gastrointestinal System		
3 cases of Peritonitis, Diffuse	58 cases of Nausea	
1 case of Peritonitis, Local	498 cases of N & E 12 Hrs. or less P. Op.	
1 case of Mesenteric Thrombosis	216 cases of N & E 24 Hrs. or less P. Op.	
3 cases of Paralytic Ileus	35 cases of N & E 2 Days or less P. Op.	
1 case of Intest. Obstruction, Partial	13 cases of N & E 2 Days or more P. Op.	
2 cases of Jaundice, Slight	1 case of Diarrhea	
1 case of Wound Separation	3 cases of Other, G. I. Misc.	
116 cases of Distention, Moderate		
4 cases of Distention, Severe		

INCIDENCE OF POSTOPERATIVE COMPLICATIONS—*Continued*

Respiratory		Total 240
46 cases of Upper Resp. Infec., Acute	15 cases of Bronchopneumonia	
5 cases of Laryngitis, Acute	23 cases of Pulm. Collapse, Partial	
86 cases of Cough	5 cases of Pulm. Collapse, Massive	
22 cases of Pharyngitis	5 cases of Pleural Effusion	
5 cases of Bronchitis, Acute	3 cases of Pneumothorax	
4 cases of Pleurisy	3 cases of Oxygen Want, Severe	
9 cases of Hiccup	3 cases of Bronchial Asthma	
1 case of Bronchial Obstruction	1 case of Oxygen Want, Moderate	
1 case of Excess Mucus	3 cases of Others, Resp. Misc.	
Metabolic and Endocrine		Total 783
1 case of Starvation	128 cases of Fever above 102	
1 case of Dehydration, Moderate	649 cases of Fever below 102	
1 case of Acidosis, Diabetic	1 case of Thyroid Storm	
1 case of Endocrine Dysfunction	1 case of Tetany	
Grand Total	Complications (not patients)	2645

POSTOPERATIVE NAUSEA AND EMESIS

Anesthetic Agent Administered

Agent	Nausea Only	Less Than			Over 2 Days	Total	Total Cases	Incidence, Per Cent
		12 Hrs.	24 Hrs.	2 Days				
Ether	32	372	108	14	5	531	1463	35.1
Nitrous Oxide	5	37	6	2	3	53	420	12.6
Cyclopropane	1	19	40	8	1	69	257	26.8
Vinethene			12			12	19	63.2
Pentothal	2	6	13		1	22	482	4.6
Other Barbiturates						0	9	0.0
Procaine	13	52	23	6	1	95	1053	9.1
Metycaine	4	9	11	1	1	26	478	5.4
Pontocaine		3	1	3	1	8	89	8.9
Nupercaine	1		2	1		4	19	2.1
Total	58	498	216	35	13	820	4289	19.1

Region of Operation

Region	Nausea Only	Less Than			Over 2 Days	Total	Total Cases	Incidence, Per Cent
		12 Hrs.	24 Hrs.	2 Days				
No Operation (000 Group)							7	0.0
Head and Neck (100 Group)	3	41	43	5	1	93	438	21.2
Thorax (200 Group)	1	15	10	1		27	112	24.1
Abdomen Intraperitoneal (300 Group)	11	53	26	7	3	100	342	22.2
Inguinal and Lumbar (400 Group)	9	49	19	4	2	83	612	13.6
Perineum (500 Group)	5	17	16	2		40	586	6.8
Extremities (600 Group)	23	280	82	13	5	403	1593	25.3
Spinal Cord and Column (700 Group)	6	43	20	3	2	74	463	16.0
Therapeutic and Diagnostic (800 Group)						0	136	0.0
Total	58	498	216	35	13	820	4289	19.1

POSTOPERATIVE COMPLICATIONS

POSTOPERATIVE URINARY RETENTION
Anesthetic Agent Administered

Agent	Catheterization	Total Cases	Incidence, Per Cent
Ether	121	1463	8.3
Nitrous Oxide	8	420	1.9
Cyclopropane	10	257	3.9
Vinethene	3	19	15.8
Pentothal	4	482	0.8
Other Barbiturates	0	9	0.0
Procaine	102	1053	9.7
Metycaine	41	478	8.6
Pontocaine	17	89	19.1
Nupercaine	3	19	15.8
Total	309	4289	7.2

Region of Operation

Region	Catheterization	Total Cases	Incidence, Per Cent
No Operation (000 Group)	0	7	
Head and Neck (100 Group)	8	438	1.8
Thorax (200 Group)	0	112	0.0
Abdomen Intraperitoneal (300 Group)	45	342	13.2
Inguinal and Lumbar (400 Group)	128	612	20.9
Perineum (500 Group)	35	586	5.9
Extremities (600 Group)	53	1593	3.3
Spinal Cord and Column (700 Group)	40	463	8.6
Therapeutic and Diagnostic (800 Group)	0	136	
Total Complications	309	4289	7.2

POSTOPERATIVE CENTRAL NERVOUS SYSTEM MORBIDITY
Anesthetic Agent Administered

Agent	Headache	Post Lumbar Puncture		Total	Total Cases	Incidence, Per Cent
		Headache	Backache			
Ether	36			36	1463	2.4
Nitrous Oxide	6			6	420	1.4
Cyclopropane	6			6	257	2.3
Vinethene	5			5	19	26.3
Pentothal	14			14	482	2.9
Procaine		72	22	94	1053	8.9
Metycaine	2	32	3	37	478	7.7
Pontocaine		2	1	3	89	3.4
Nupercaine		3	1	4	19	21.1
Other Barbiturates				0	9	0.0
Total	69	109	27	205	4289	

POSTOPERATIVE RESPIRATORY MORBIDITY

(Chest Surgery excluded)

ANESTHETIC AGENT ADMINISTERED

Agent	Major Postop. Complication	Minor Postop. Complication	Total Comp.	Total Cases	Incidence Per Cent
Ether (not intubated)	5	62	95	1446	6.6
Ether (intubated)	8	20			
Nitrous Oxide	2	9	11	399	2.8
Cyclopropane (not intubated)	1	6	9	213	4.2
Cyclopropane (intubated)	1	1			
Vinethene		3	3	19	15.8
Pentothal	1	3	4	466	0.8
Other Barbiturates				9	0.0
Procaine (Infiltration)	1	9			
Procaine (Spinal)	10	49	72	1041	6.9
Procaine (Cont. Spinal)	2	1			
Metycaine (Spinal)	7	17	26	476	5.5
Metycaine (Caudal)		2			
Pontocaine (Spinal)	2	4	6	89	6.7
Nupercaine (Spinal)		3	3	19	15.8
Total	40	189	229	4177	

Total Resp. Morbidity 5.5
Total Major Complication Incidence 0.9
Minor Complication Incidence 4.6

Major Postoperative Complications: All pneumonias, lung abscess, empyema, partial or massive pulmonary collapse, and major degrees of obstruction or depression.

Minor Postoperative Complications: Cough, tracheitis, bronchitis, laryngitis, pharyngitis, pleurisy, hiccup, oxygen lack and minor degrees of obstruction or depression.

POSTOPERATIVE RESPIRATORY MORBIDITY
(Chest Surgery Only)
Agent and Technic

Agent	Major Complications	Total Major Complications	Total Cases	Incidence Per Cent
Ether (not intubated)	1	3	17	
Ether (intubated)	2			
Nitrous Oxide	1	1	21	
Cyclopropane (not intubated)	1			
Cyclopropane (intubated)	2	3	44	
Pentothal	0	0	16	
Procaine	0	0	12	
Metycaine	0	0	2	
Total	7	7	112	6.3

MORTALITY STUDIES

Included are deaths occurring during the patient's stay in the hospital following the administration of an anesthetic agent

Sex	Age and Sex								Total Deaths	Total Cases	Incidence, Per Cent
	0–1	1–9	10–19	20–29	30–39	40–49	50–59	60–69			
Males				13	4	1	1		19	4210	
Females				1					1	79	
Total				14	4	1	1		20	4289	0.46

PHYSICAL STATUS PREOPERATIVELY

	Good	Fair	Poor	Serious	Emergency		Moribund	Total
					Good	Poor		
Deaths	5	4	4	1		2	4	20

AGENT ADMINISTERED, TECHNIC AND TIME OF DEATH

Time of Death	Ether	Cyclo-propane	Pento-thal	Pro-caine (Spinal)	Pro-caine (Infilt.)	Mety-caine (Sp.)	Ponto-caine (Sp.)	Total
During Operation								
Operative Day		2			3			5
1–3 Days Postop.	1	1		1	1			4
4–7 Days Postop.	1	1	2	1		1		6
2nd Week Postop.	1			1		1	2	5
3rd Week Postop.								
Total	3	4	2	3	4	2	2	20

DURATION OF ANESTHESIA

	½ Hr.	1 Hr.	1½ Hr.	2 Hrs.	3 Hrs.	4 Hrs.	5 Hrs.	6 Hrs.	Total
Deaths	1	3	4	3	5	2		2	20

DISCUSSION

The Army is one of the oldest and presently the largest institution in the country. As in other great organizations, there is a wealth of facts, recorded in every decade, which must be evaluated and integrated for posterity. The Medical Corps, in particular, shares this burden to fulfill its function of providing the most modern and adequate care for its sick and wounded. Studies on the morbidity and mortality due to anesthetic management and/or surgical treatment in World War I have been reported in a few publications and have been both informative and instructive. The volume of data, anticipated in the present conflict, will tremendously overshadow previous records and, accordingly, an objective and mechanical system, designed to accommodate and integrate an almost infinite amount of data, was much desired. This is now available and, as the results in the report have shown, the modified Hollerith punch card system is readily adaptable to record any amount of anesthetic or surgical data.

The Hollerith punch card system has been accepted as an aid in statistical studies by many industrial concerns, by many departments of anesthesia in leading university and civilian hospitals and by the American Society of Anesthetists. It is used by the Diplomates of the Board of Anesthesiologists and other competent anesthetists, many of whom are serving in the Army. It is an inexpensive method, easy to learn and use and, at the present time, ideally suited for recording and evaluating mass data. Although it is more detailed than the method of Nosworthy (6), it is more inclusive and unlimited in its use. The simplicity of its use has been demonstrated at our posts by the fact that enlisted men can be trained to help with coding and punching during their leisure. Its growing popularity has already been noted

with its use by competent anesthetists at many named and numbered general hospitals (7).

The data reported serve merely to indicate the successful application of the modified Hollerith punch card system at general hospitals and the mass of surgical and anesthetic data that can be compiled. Similar records at other surgical installations can be kept just as easily and as satisfactorily. Their combined total would constitute the most complete surgical record ever tabulated in the world and one which would be particularly adaptable for statistical studies of innumerable surgical and anesthetic data. Such a comprehensive evaluation of facts would not only guide us in the solution of medical problems of future wars but also serve to emphasize today the efficiency and success of the Army Medical Corps in caring for its sick and wounded.

SUMMARY AND CONCLUSIONS

A combined statistical report from the anesthesia departments of two Army General Hospitals is reported. In general, the figures indicate the trends in choice of agents, technics, and the numbers of operative procedures actually completed. Because of the relatively small number of cases reported, it is believed that no definite conclusions concerning complications can be drawn.

The method of collecting surgical and anesthetic data by use of a standard code and a punched card is emphasized. The type and completeness of information obtainable is demonstrated.

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