

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 *

MAJOR C. P. WANGEMAN AND MAJOR S. J. MARTIN
Medical Corps, Army of the United States

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 4,089 cases from the two hospitals, to illustrate the method of recording

* Read before the Section on Anesthesiology at the Ninety-Fourth Annual Session of the American Medical Association, Chicago, June 14, 1944.

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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

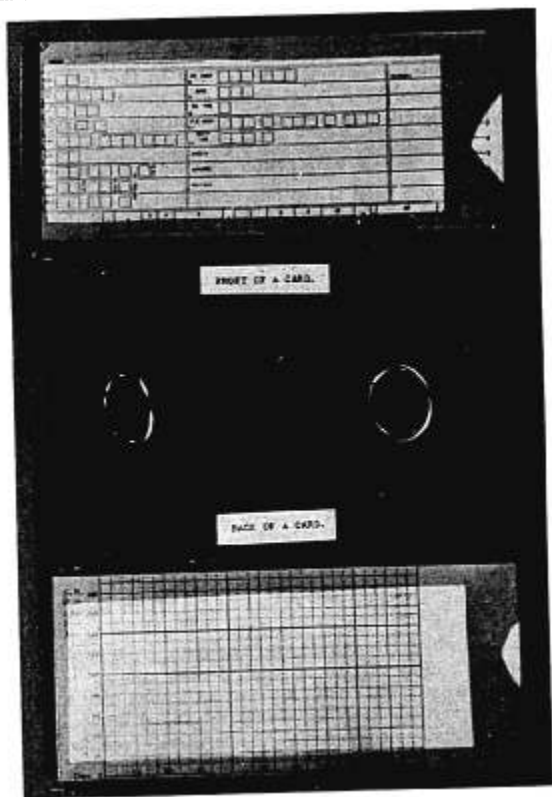


FIG. 1. Modified Hollerith punch card in holder.

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.

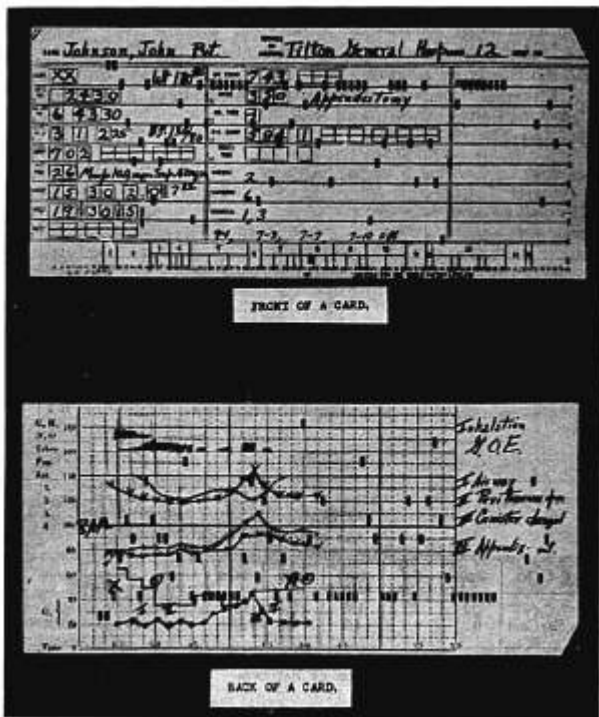


FIG. 2. Completed punched card ready for sorting.

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—Morbidity Conditions—Initiating Diseases

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
Incidence, Per Cent	0.5	0.1	4.3	5.6	31.4	4.8	1.8	0.2	4289

SEX OF PATIENTS

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

PHYSICAL STATUS OF PATIENTS

	No Data	Good	Fair	Poor	Serious	Emergency		Morbund	Total
						Good	Poor		
Incidence, Per Cent	0.7	85.9	6.4	1.1	0.3	4.6	0.8	0.01	4289

DETAILED STUDY BY REGION
PHYSICAL STATUS PREOPERATIVELY

Region	Good	Fair	Poor	Se- rious	Emergency		Mor- bund	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.....								
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 Intra-peritoneal	Total for 200 group.....								
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 Extra-peritoneal	Total for 300 group.....								
Abdomen Extra-peritoneal 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.....								
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.....								
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.....								
Neurologic.....	61	6		1				2	70
Orthopedic.....	381	7			2			3	393
Therapeutic and Diagnostic	Total for 700 group.....								
Therapeutic.....	58	6	1		3				64
Diagnostic.....	69	1			2				72
	Total for 800 group.....								
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
			<u>827</u> Total
		Circle Absorption.....	65 To and Fro Endotracheal
			3 To and Fro Pos. Pressure
			6 To and Fro Control Resp.
			97 Absorption To and Fro
			<u>171</u> Total
		To and Fro Abs.	5 Semi-closed, Endotracheal
			4 Semi-closed
			<u>9</u> Total
		Semiclosed.....	47 Open Drop Endotracheal
			396 Open Drop
			13 Pharyngeal Insufflation
			<u>456</u> Total
		Open.....	2 Abs. Circ. Endotracheal
			5 Abs. Circ. Pos. Pressure
			259 Absorption in Circuit
			<u>266</u> Total
		Circle Absorption.....	1 To and Fro Endotracheal
			39 Absorption To and Fro
			<u>40</u> Total
		To and Fro Abs.....	80 Total
			34 Pharyngeal Insufflation
			3 Abs. Circ. Endotracheal
			6 Absorption in Circuit
			<u>9</u> Total
		Circle Absorption.....	46 To and Fro Endotracheal
			4 To and Fro Control Resp.
			195 Absorption To and Fro
			<u>245</u> Total
		To and Fro Abs.....	3 Insuffl. Pharyngeal Total
			<u>19</u> Total
		Open.....	201 Without Ephedrine Sulfate
			598 With Ephedrine Sulfate
			5 With other Adrenergic Drug
			<u>30</u> Continuous Spinals
			<u>834</u> Total
		Spinals.....	42 Total
			2 Total
			<u>137</u> Total
		Infiltration.....	38 Total
			151 Without Ephedrine Sulfate
			203 With Ephedrine Sulfate
			1 With other Adrenergic Drug
			<u>1</u> Continuous Spinal
			<u>356</u> Total
		Spinal.....	65 Total
			2 Total
			<u>6</u> Total
			49 Total
			26 Without Ephedrine Sulfate
			59 With Ephedrine Sulfate
			3 With other Adrenergic Drug
			<u>88</u> Total
		Spinal.....	1 Total
			6 Without Ephedrine Sulfate
			13 With Ephedrine Sulfate
			<u>19</u> Total

RECORDING DATA IN ARMY HOSPITALS

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	Duration (Hrs.)										Total
		5 Min.	1 Hr.	1 Hr.	1 1/2 Hr.	2 Hr.	3 Hr.	4 Hr.	5 Hr.	6 Hr.		
Ether.....	5	2	75	388	390	383	203	81	27	9	146	
Nitrous Oxide.....		11	185	132	51	29	10	2			42	
Cyclopropane.....		2	40	46	55	54	53	6	1		257	
Vinethene.....		2	17								19	
Pentothal.....		33	295	93	24	17	14	5	1		488	
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	100	

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	3 Aur. Fibrillation		
1 Aneurysm, Misc.	5 Other Arrhythmia		
3 Arterioscl. Gen.	9 Hemorrhage, Moderate		
9 Phlebitis	5 Hemorrhage, Severe		
5 Other Vas. Dis.	8 Tachycardia		
1 Endart. Obliterans	1 Bradycardia		
3 Funct. Capacity 1	7 Hypertension		
1 Funct. Capacity 11	4 Hypotension		
8 Ht. Dis. Thyrotoxic	1 Shock Traumatic		
1 Accid. Div. Imp't Bl. Vessel	2 Bl. P. Rise Marked		
6 Ht. Dis. Rheumatic	1 Ht. Dis. Coronary		
6 Ht. Dis. A-Scler. and Hyperten.	2 Pul. Embolus		
4 Ht. Dis. Luetic	1 Ascites		
1 Myocard. Degeneration	4 Others, Ht. Dis.		
2 Heart Block		Total	103
Central Nervous System			
7 Apprehension Marked	1 C.N.S. Lues		
1 Excitement Marked	1 Myelitis, Transverse		
12 Neurosis	1 Meningeal Hemorrhage		
1 Epilepsy	1 Encephalitis		
36 Psychosis	1 Brain Abscess		
1 Meningitis	20 Headache		
4 Increased Intracran. Pres.	3 Paralysis		
6 Concussion	1 Backache		
5 Skull Fracture	2 Headache Post. Lum. Punc.	Total	46
Genitourinary System			
2 Anuria	4 Epidid., Orchitis		
1 Azotemia	3 Prostatitis		
4 Low Kidney Function	9 Albuminuria		
5 Pyelitis, Pyelonephr.	21 Hydronephrosis		
3 Pyelitis, Pyelonephr. TBC	4 Reten. Obstr. Moder.		
9 Cystitis	5 Reten. Obstr. Severe		
4 Hematuria	2 Ruptured Bladder		
1 Hypernephroma	1 Chronic Nephritis	Total	46
Blood, Drug and Technical			
1 Leukemia	57 Secondary Anemia Mod.		
1 Bl. Dyscrasia, Others	7 Secondary Anemia Severe		
1 Hemolytic Jaundice	69 Leukocytosis		
2 Splenomegaly	5 Idiosyncrasy to Drugs		
1 Agranulocytosis	309 Previous Operation	Total	121
8 Syphilis			
Gastrointestinal System			
3 Perforated Peptic Ulc.	1 Gastritis		
4 Peptic Ulc. (not Perf.)	1 Diverticulitis		
1 Evisceration Intest.	1 Pancreatitis		
1 Peritonitis Diffuse	6 Nausea and Emesis		
4 Intest. Obst. Compl., Early	10 Jaundice, Slight		
3 Intest. Obst. Compl. Late	2 Jaundice, Severe		
3 Other Lower Obst.	66 Acute Appendicitis		
3 Choledocholithiasis	1 Paralytic Ileus		
1 Hepatitis	4 Distention, Mod.		
4 Colitis	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

Gastrointestinal		Total	286
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	510
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	12
Obstetrical			
1 case of Baby Premature	1 case of Other Hemorrhage		
Grand Total	Complications (not Patients)		1233

INCIDENCE OF POSTOPERATIVE COMPLICATIONS

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

Circulatory System		Total	33
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	161
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.		Total	22
27 Backache, Post-Lumb. Punct.			
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	157
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	Nau- sea Only	Less Than			Over 2 Days	Total	Total Cases	Inci- dence, 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	Nau- sea Only	Less Than			Over 2 Days	Total	Total Cases	Inci- dence, 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 Intra-peritoneal (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	4.8

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	6.3
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	

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	0.45
Females				1					1	79	
Total.....				14	4	1	1		20	4289	

PHYSICAL STATUS PREOPERATIVELY

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

AGENT ADMINISTERED, TECHNIC AND TIME OF DEATH

Time of Death	Ether	Cyclopropane	Pentothal	Pro-caine (Spinal)	Pro-caine (Infil.)	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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