SPECIAL ARTICLE

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French Survey of Anesthesia in 1996

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Background: **To identify the growth in the number of anesthetic procedures since 1980 and the changes in the practice of anesthesia, the present survey was designed to collect and analyze the anesthetic activity performed in France in 1996, from a representative sample collected in all French hospitals and clinics.**

Methods: **This study, initiated by the French Society of Anesthesia and Intensive Care, collected information that included the characteristics of patients (age, sex, American Society of Anesthesiologists status), the techniques of anesthesia, and the nature of the procedure for which anesthesia was required. All French private, public, and military hospitals were asked to participate in the survey. In each hospital in the country, all anesthetic procedures were documented and collected during 3 consecutive days, chosen at random during a 12-month period, to obtain a representative sample of the annual activity. All data were analyzed at the INSERM (National Institute of Health and Medical Research). At the conclusion of the study, 5% of hospitals were randomly assigned to be audited to check for missing data and errors. The rate of anesthetic activity was calculated as the ratio between the annual number of anesthetic procedures and the number of the general population in the same age group.**

Results: **The participation rate of hospitals was 98%. The analysis of the 62,415 collected questionnaires allowed extrapolation of the anesthetic activity to 7,937,000 anesthetic procedures (95% confidence interval, ± 387,000) performed in France in 1996. Thus, the annual rate of anesthetic procedures was 13.5 per 100 population, varying between 5.4 per 100 in girls aged 5–14 yr and 30.2 per 100 in men aged 75–84 yr. Surgery was involved in 71% of anesthesia cases. Regional anesthesia alone was performed in 20% of all surgical cases and was combined with general anesthesia in 3% of additional cases. Anesthesia for obstetric procedures represented 9% of all cases. Seventy-six percent of all anesthetic procedures started between 12:00 A.M. and 7:00 A.M. were related to obstetric activities.**

Conclusion: **In comparison with a previous study, the present survey shows that the number of anesthetic procedures has increased by 120% since 1980, and the rate of anesthetic procedures increased from 6.6 to 13.5 per 100 population, the major changes being observed in patients aged ≥ 75 yr and in those with an American Society of Anesthesiologists physical status of 3. In the same time period, the number of regional anesthetic procedures increased 14-fold. In obstetrics, the practice of epidural analgesia extended from 1.5% to 51% of all deliveries of the country. (Key words: Anesthetic activity; economics; regional anesthesia.)**

This article is featured in "This Month in Anesthesiology." Please see this issue of ANESTHESIOLOGY, page 7A.

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MEDICAL activity changes continuously because of economic factors, introduction of new drugs and technology, and demographic variations. Different studies have shown that the activity of surgery has grown over the last decades.[1,2] However, these studies have focused on the types of procedures performed and did not examine the changes in the characteristics of patients submitted to all surgical activities. The evolution of anesthetic activity has probably followed the growth of surgery, but no study has yet addressed these changes. Many factors may have contributed to a growth of the anesthetic activity.

With the current increase in life expectancy, the number of people aged > 65 yr has reached 15–19% of the

population for European countries and will be > 20% for most European countries, Canada, and Japan in 2025.[3] With continuing improvement in safety, anesthesia has enabled surgery to be progressively extended to patients at the extremes of age and with more severe conditions. These changes have a great influence on the activity of anesthesiologists, because the proportion of the elderly population undergoing anesthesia is growing faster than the growth of the whole population of the same age.[4] However, knowledge of the evolution of the annual rate of anesthetic procedures in the population of developed countries is lacking.[5]

Because anesthesia is involved in a large proportion of surgical, obstetric, and invasive radiologic or gastrointestinal procedures, analysis of the practice of anesthesia may offer a global overview of the type of surgically and medically invasive activities that are performed. Such an analysis can provide important information on the changes in the characteristics of patients undergoing anesthesia for surgery and other nonsurgical diagnostic or therapeutic procedures. In addition, anesthesia has favored the development of procedures performed in the ambulatory setting and outside the operating theater.[6,7] However, these developments of anesthetic activity have never been evaluated at a national level.

In the present difficult economic context, surgical suites have been reported to consume 9% of hospitals' annual budgets.[8] It has been suggested that services related to surgery for in-patients represent 40% of hospital costs and revenues. Operating rooms and anesthesia are responsible for 33% and 9.3% of these costs, respectively.[9] Repeated evaluations of the practice of anesthesia and surgery are important to facilitate adaptation of the organization of hospitals to the observed changes in activities and characteristics of patients.

The determination of the risk of anesthesia requires the study of both the number of accidents and deaths during a time period and the number of all anesthetic procedures performed during the same time period. Most recent studies on the risk of anesthesia, as well as the Closed Claims Project, analyzed closely the number of deaths and major accidents, whereas the denominator, the total number of anesthetic procedures, was estimated but not measured.[10–13] The knowledge of the number of anesthetic procedures and of the characteristics of patients would help with the calculation of the risk of anesthesia in the total population, as well as in the various subgroups of patients.

To test the hypothesis that the practice of anesthesia has increased and changed, a large survey was conducted in France in 1996. The survey collated and analyzed the anesthetic activity from a representative population sample, collected in all hospitals and private clinics in the country, and included data on patient characteristics, anesthetic techniques, and the type of procedures for which anesthesia was required. An extensive report of the results of this survey was recently published in French.[14] The present article synthesizes the results of the larger study, with a special focus on its essential components, such as the conditions of anesthesia for surgery and obstetrics, and emergency anesthesia. It also points out the changes that have occurred in anesthetic activity by a comparison with a previous survey conducted in 1980.[15,16]

Patients and Methods

The present survey was initiated by the anesthesia patient safety committee of the French Society of Anesthesia and Intensive Care. The study was conducted in collaboration with the French National Institute of Health and Medical Research (units SC8 and SC25 of INSERM), which provided methodologic advice and logistics. The design was approved by the National Medical Association (Conseil National de l'Ordre des Médecins) and by the French National Commission of Informatics and Liberty after a guarantee was provided concerning the total anonymity of the patients' data.

To obtain a representative population sample, including a sufficient number of cases in all age groups and in all American Society of Anesthesiologists (ASA) classes, it was estimated from the data of a previous study performed in 1980[16] that the size of the sample should be > 60,000 cases. Using the data of the annual number of surgical cases estimated in France in 1993, such a sample required a survey that would collect information on all anesthetic procedures during 3 consecutive days.

France was divided into 30 geographical regions, including overseas departments and territories (Martinique, Guadeloupe, Guyana, Réunion, New Caledonia, Tahiti). Each month, two or three geographical regions were randomly designed to be surveyed. Within each geographical region, the first day of the survey was randomly allocated for each institution, with a stratification for public and private centers. Every hospital or private clinic was surveyed during 3 consecutive days. The survey was undertaken from February 1, 1996, to January 31, 1997.

With this method, a representative sample of the an-

nual activity of anesthesia in France could be obtained, including the 12 months of the year, the 7 days of the week, as well as weekends, holidays, and all nonworking days.

A good understanding by all French anesthesiologists of the importance of participating in this study was essential. All French anesthesiologists received a letter from the presidents of the French Society of Anesthesia and Intensive Care and of the anesthesia patient safety committee. Their representatives were informed of the project and were asked to be involved in the implementation of the survey. The establishment of this network played a major role in obtaining full cooperation for the project. The nurse-anesthetist organization was also informed and gave their full support during the conduct of the survey. Information was sent to the medical directors of all university hospitals, to the administrative directors of all public and private institutions, and to the medical inspector of each regional health agency.

All types of institutions were included in the survey, including university, general, military, and private hospitals. A Regional Steering Committee was created within each region. Information meetings were organized with the Regional Steering Committee of each region in the presence of a coordinator of the survey, in which the tasks of the Regional Steering Committee were explained. The tasks consisted of the following: (1) check the list of all institutions in which anesthesia was delivered within their region, call the anesthesiologists of these institutions, obtain their agreement to participate in the survey, and decide on a coordinating anesthesiologist for each institution; and (2) before the start of the survey, obtain from each institution the approximate number of questionnaires needed.

At the end of the 3-day survey, each coordinating anesthesiologist had to collect all completed questionnaires from all anesthesiologists of his institution, check for missing or incomplete questionnaires, detach the names of the patients from the questionnaires to provide complete anonymity, and send all of the questionnaires in a prepaid envelope to the INSERM office. A telephone call was made to the coordinating anesthesiologist if the questionnaires had not been received at the INSERM office 2 weeks after the end of the survey. If the questionnaires were still not obtained within the following week, the coordinator of the Regional Steering Committee called the coordinating anesthesiologist to obtain the completed questionnaires.

In addition, 5% of all institutions were randomly assigned to be audited in each region. This validation process was performed separately for public and private institutions. A member of the National Steering Committee, or an expert anesthesiologist named by the National Steering Committee, visited the institution and checked the validity of the data collected in the questionnaires. In addition, missing questionnaires were checked using data from operating rooms, recovery rooms, and obstetric suites. Even with the anonymity of the questionnaires, the included information (patient's date of birth and sex, date of anesthesia, time of start and end of the procedure, nature of the procedure, technique of anesthesia, urgent or elective case) enabled a check to be made of the validity of their data with hospital data.

The objective of the survey was to identify three types of information, as shown in the questionnaire presented in the appendix: (1) main characteristics of the patients undergoing anesthesia: age, sex, and ASA physical status; (2) anesthesia: urgent or elective case, starting time and end of anesthesia, general anesthesia (GA) or regional anesthesia (RA), technique of airway management, pharmacologic agents used during anesthesia (excluding premedication); and (3) procedure: type of surgery, endoscopy, obstetric labor, cesarean section, laparoscopic procedure, radiologic or cardiologic investigation.

One questionnaire was completed for every anesthetic procedure that was performed by an anesthesiologist or under his supervision, in an operating room or in a site specifically dedicated for anesthesia. Anesthetic procedures performed outside a hospital (*e.g.*, in a medical ambulance) or in an intensive care unit were not included in the survey. Furthermore, procedures performed with local anesthesia by surgeons or any other professional without the presence and the responsibility of an anesthesiologist were not included in the survey.

The starting time of anesthesia was defined as the time of induction of anesthesia. The end of anesthesia was defined as the time when the patient left the site of anesthesia to be admitted to the recovery room or any other site of supervision. Emergency cases were defined as cases that were judged urgent by the anesthesiologist.

Data analysis was performed by the INSERM unit SC8 using a VAX 4000 computer (Digital Equipment, Maynard, MA) and the SAS statistical program (SAS Institute, Cary, NC). Comparisons between collected data and missing data were made using the chi-square test.

Results

The participation rate among all institutions was 98% and varied to 100% for university hospitals (n = 105),

Table 1. Annual Rate of Anesthetics in the Different Age Groups

Age (yr)	Rate of Anesthesia for Male (per 100 population)	Rate of Anesthesia for Female (per 100 population)
<1	11.6	7.1
1–4	14.2	8.3
5–14	7.0	5.4
15–24	7.3	10.7
25–34	7.5	17.8
35–44	8.9	13.2
45–54	13.2	14.4
55–64	17.7	14.6
65–74	25.1	18.8
75–84	30.2	23.5
>84	26.3	20.8

private centers participating in the public health service (n = 118), and military hospitals (n = 18); to 99% for general hospitals (445 of 448); and to 97% for private clinics (870 of 894).

The audit process found that the percentage of missing questionnaires calculated during the validation visit was 1.9%. The analysis of missing data obtained during these visits showed that there was no significant difference between missing and collected data with regard to patient age, sex ratio, type of anesthesia, and type of procedure.

Global Result

A total of 62,415 questionnaires was collected. After correction due to the rate of participating centers and

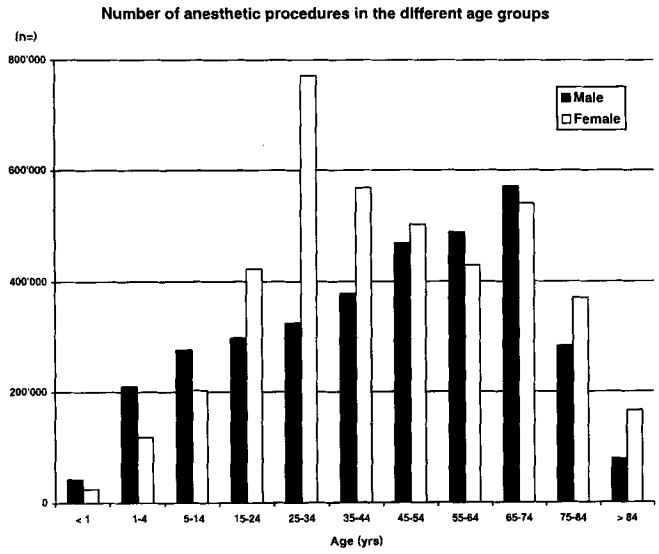

Fig. 1. Distribution of the estimated number of anesthetic procedures in patients of both sexes among the different age groups.

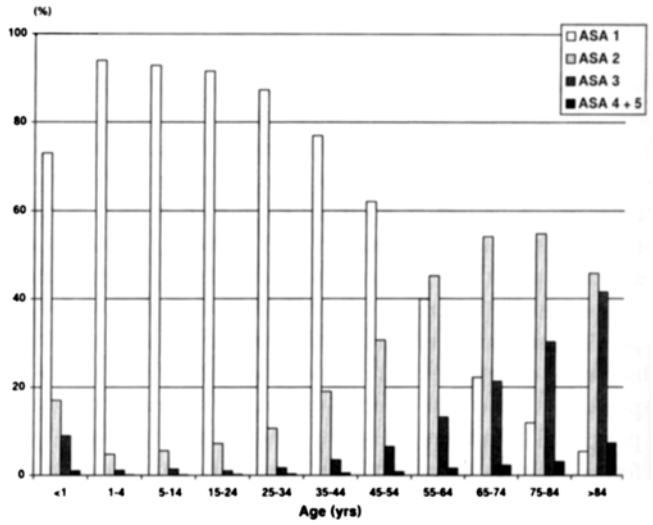

Fig. 2. Distribution of anesthetic procedures within the different age groups and the different American Society of Anesthesiologists classes.

missing data, the number of anesthetic procedures was estimated to be 65,058. This extrapolates to 7,937,000 anesthetic procedures (95% confidence interval, ± 387,000) performed in France in 1996. Thus, based on the total population of the country, the annual rate of anesthetic procedures was 13.5 per 100 population. The annual rate of anesthetic procedures varied widely between age groups, from 5.4 per 100 in girls aged 5–14 yr to 30.2 per 100 in men aged 75–84 yr (table 1).

Fifty-five percent of anesthetic procedures were performed in women with a peak age between 25 and 34 yr (fig. 1). Twelve percent of anesthetics were given to children younger than 14 yr. One third of cases were performed in patients older than 60 yr, whereas 3% of all anesthetic procedures were performed in patients ≥ 85 yr. The number of anesthetic procedures was greater in women than in men ≥ 75 yr of age.

Fifty-nine percent of anesthetic procedures were performed in patients with an ASA status of 1, 29% in those with an ASA status of 2, 11% in those with an ASA status of 3, and 1% in those with an ASA status of 4–5. The distribution of anesthetic procedures for each age group within the different ASA classes showed that 81% of anesthetic procedures in patients with an ASA status of 3–5 were performed in patients aged ≥ 55 yr (fig. 2). However, in patients aged ≥ 85 yr, one half of the anesthetic procedures were still performed in patients with an ASA status of 1–2, and < 10% of procedures were performed in those with an ASA status of 4–5.

The procedures that required anesthesia were surgery

in 71% of all cases and obstetrics in 9%. The remaining 20% included other procedures such as endoscopies and radiologic or other diagnostic or therapeutic nonsurgical procedures.

General anesthesia was performed in 77% of all cases (including all techniques of sedation), whereas RA was performed in 21% of cases, including RA alone (16%) and RA associated with sedation (5%) using intravenous agents. In the remaining 2% of cases, a combined technique was performed, associating RA with intravenous and volatile anesthetic agents, muscle relaxants, or tracheal intubation.

During GA, a tracheal tube or a laryngeal mask was used in 45% and 10% of cases, respectively. Tracheal intubation and laryngeal mask insertion were associated with administration of muscle relaxants in 84% and 14% of cases, respectively.

For RA, the different techniques used were an intrathecal anesthesia (28% of cases), an epidural anesthesia (28%), peribulbar blocks (16%), peripheral plexus or nerve blocks (15%), and Bier's block (5%). The distribution of intrathecal and epidural techniques between obstetric and surgical cases showed that 84% of epidural anesthesia procedures were performed for obstetric cases, whereas 88% of intrathecal anesthesia procedures were performed for surgical procedures.

The distribution of anesthesia through the week showed that 93% of the activity was performed between Monday and Friday. Daily activity varied between 17% of the total activity on Fridays and 21% on Tuesdays, whereas 5% and 2% were conducted on Saturdays and Sundays, respectively. Anesthesia started between 7:00 A.M. and 1:00 P.M. in 71% of cases and between 1:00 P.M. and 6:00 P.M. in 23%. The remaining 6% started between 6:00 P.M. and 7:00 A.M.; 76% of these cases were initiated before 12:00 A.M. The type of procedures that required anesthesia differed according to the time at which it had started. Between 6:00 P.M. and 0:00 A.M., anesthesia for surgery and obstetrics represented 67% and 26% of cases, respectively. In contrast, between 0:00 A.M. and 7:00 A.M., anesthesia for obstetrics represented 76% of cases, whereas surgery represented only 22% of the activity.

Anesthesia for Surgery (Excluding Obstetric Cases)

The annual rate of anesthesia for surgery was 9.5 procedures per 100 population. The distribution of anesthesia for surgical procedures within the different age groups is shown in figure 3. In patients aged < 25 yr, anesthesia for surgery was more frequent in males than

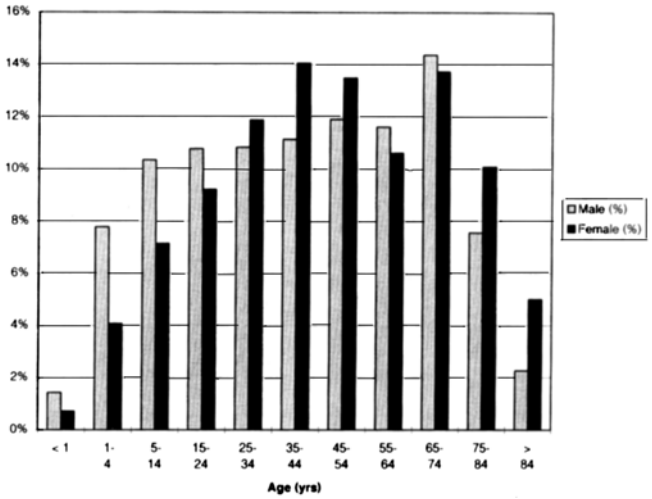

Fig. 3. Distribution of anesthetic procedures performed for surgery (excluding obstetrics and endoscopies).

in females, whereas it was more frequent in women in the 25–54-yr and ≥ 75-yr age groups. A large part of anesthetic activity for surgery concerned elderly patients; 26.5% was performed in patients aged ≥ 65 yr. In patients aged > 74 yr, the annual rate of anesthesia for surgery was greater in men (19.6 per 100) than in women (16.8 per 100).

The median duration of anesthesia for surgical cases was 60 min. In 10% of procedures, the duration was shorter than 16 min or longer than 155 min.

The agents used for GA in surgery, excluding premedication, were opiates in 86%, N_2O in 81%, intravenous hypnotics in 80%, volatile agents in 77%, muscle relaxants in 55%, benzodiazepines in 41%, and neuroleptics in 3%.

Regional anesthesia was used in 21% of all anesthetic procedures for surgery, including RA alone (15%) and RA associated with sedation (6%), and was combined with GA in 2% of additional cases. Among the different techniques of RA for surgery, the most frequent were intrathecal (35%) and peribulbar (22%) anesthesia, followed by plexus and nerve blocks (21%), Bier's blocks (7%), and epidural anesthesia (5%). A sedative agent was administered to complement an RA in 39% of patients who received a regional block and in 50% of RA in ophthalmology.

Anesthesia for orthopedic surgery was the most frequent procedure (26%) in surgery, followed by anesthesia for digestive surgery (13%), ear-nose-throat surgery (12%), gynecology (10%), ophthalmology (8%), and urology (8%). Forty-four percent of all RA performed in surgery were orthopedic cases. Anesthetics for fractured

Table 2. Distribution of Anesthetic Procedures among Different Surgical Specialties and within Different Age Groups

	Age (yr)							
	<1 (%)	1–4 (%)	5–14 (%)	15–54 (%)	55–74 (%)	75–84 (%)	≥85 (%)	Total (%)
Orthopedic	5.3	5.6	22.1	29.1	26.3	23.9	35.8	25.9
Digestive	23.9	4.6	18.7	11.8	15.9	13.4	12.6	13.3
ENT	24.9	63.9	28.4	8.3	4.3	1.9	0.9	11.6
Gynecology	2.8	0.4	0.4	17.0	6.2	3.0	2.0	9.9
Ophthalmology	9.0	2.8	2.8	2.1	12.8	29.8	27.5	8.4
Urology	13.3	13.2	8.3	4.0	11.5	10.9	7.6	7.6
Stomatology	1.3	1.6	9.1	7.1	1.0	0.7	0.3	4.6
Vascular	1.5	0.0	0.1	4.4	7.6	5.3	4.1	4.6
Plastic	6.1	2.7	3.3	3.8	1.9	1.3	1.6	2.9
Spinal	0.2	0.1	0.2	2.8	1.6	0.9	0.3	1.8
Endocrine	0.2	0.0	0.1	1.3	1.2	0.4	0.0	1.0
Maxillofacial	2.8	0.8	1.2	1.3	0.5	0.6	0.7	1.0
Cardiac	2.2	0.4	0.3	0.3	1.9	1.4	0.9	0.9
Intracranial	1.5	0.4	0.4	0.6	0.7	0.7	0.4	0.6
Pulmonary	0.4	0.0	0.1	0.5	1.0	0.7	0.1	0.6
Multiple	1.5	1.2	0.7	1.3	1.6	1.4	0.7	1.3
Others	2.8	2.4	3.5	4.2	4.0	3.7	4.3	3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

ENT = ear, nose, and throat surgery.

hip surgery and total hip prosthesis, which represented 4% and 7% of all orthopedic cases, respectively, were performed using an RA technique in 53% and 31% of cases, respectively. Anesthetics for arthroscopic procedures represented 13% of all orthopedic surgery cases and were performed with a GA in 69% of cases. In 77% of cases performed for shoulder surgery, a GA was chosen. An RA was used in 53% of upper-extremity orthopedic cases.

In anesthesia for digestive surgery, the most frequent procedures were appendectomy (22%), inguinal herniorraphy (20%), and cholecystectomy (13%). A laparoscopic approach was used in 77% of cholecystectomies and in 27% of appendectomies.

The distribution of anesthesia among the main surgical activities within the different age groups is shown in table 2. In infants aged < 1 yr, anesthesia for ear-nose-throat, digestive, urologic, ophthalmologic, and orthopedic surgery represented, by decreasing order, more than three fourths of all anesthesia for surgical procedures. In children aged 1–4 yr, anesthesia for ear-nose-throat procedures represented nearly two thirds of all anesthetics for surgery. In patients aged ≥ 75 yr, more than half of all anesthetics administered for surgery were given for ophthalmologic and orthopedic procedures.

The choice of the technique of anesthesia and airway management was markedly influenced by the type of surgery (table 3) and the duration of the procedure (fig. 4). In addition, the duration of anesthesia and the age of patients were related to the use of these techniques (table 4).

Emergency Anesthesia

Fifteen percent of anesthetic procedures were performed for emergency cases, 60% of which were females. When considering the different age groups, one half of emergency cases were patients aged 15–44 yr. Anesthetics for emergency cases amounted to 17% of all procedures performed in children younger than 1 yr, 23% in children aged 5–24 yr, 28% in patients aged 25–34 yr, and 21% in patients aged ≥ 85 yr. The distribution of anesthesia among ASA classes showed that 66% of emergency cases were ASA 1, 19% ASA 2, 11% ASA 3, and 4% ASA 4–5.

The type of procedure requiring emergency anesthesia was surgery in 64%, obstetrics in 27%, and a radiologic, gastrointestinal, or other investigation in 9%. Of all the anesthetic procedures performed for surgical emergencies, orthopedic, digestive, and gynecologic procedures were the most frequent and represented 43%, 24%, and 7% of cases, respectively.

The technique of anesthesia for emergencies was a GA in 80% of cases and a RA in 19%, including RA alone (14%) and RA associated with sedation (5%). A combined technique was performed in the remaining 1% of cases. There were differences among the techniques of RA used for emergency and elective surgery cases. The most

Table 3. Use of Different Techniques of Anesthesia, of Airway Management, and of the Main Anesthetic Agents for Anesthesia Performed for Different Surgical Specialties

	% GA	% GA with Intubation	% GA with LMA	% GA with Opiates	% GA with Volatile	% GA with Muscle Relaxants
ENT	100	48	5	51	88	33
Endocrine	100	99	0	99	86	88
Maxillofacial	98	77	6	91	72	50
Stomatology	98	87	2	93	82	61
Cardiac	98	93	0	98	28	91
Intracranial	96	90	0	94	61	75
Spinal	96	94	0	99	80	87
Gynecology	95	53	14	94	67	52
Plastic	90	59	13	88	70	50
Digestive	89	84	8	96	86	85
Vascular	68	65	19	95	77	62
Urology	65	44	22	86	77	42
Orthopedic	60	50	20	90	76	46
Ophthalmology	34	67	11	83	72	60
All surgery	80	61	12	86	77	55

ENT = ear, nose, and throat surgery; GA = general anesthesia; LMA = laryngeal mask airway.

frequent RA techniques used for surgical emergencies were plexus and nerve blocks (43% of all RA cases) and Bier's blocks (13%); these techniques were used in 18% and 6% of elective RA surgery cases, respectively. Peribulbar anesthesia represented only 2.5% of RA techniques for surgical emergencies *versus* 25% for elective cases.

Anesthesia for Obstetrics

Anesthesia for obstetrics, including all cases performed for pregnancy-related procedures, consisted of anesthesia for labor and vaginal delivery in 54%, cesarean sections in 18%, uterine manipulations or removal of retained placenta in 5%, voluntary interruption of pregnancy in 18%, and various pregnancy-related procedures, such as ectopic pregnancies or cervical cerclage, in 5%.

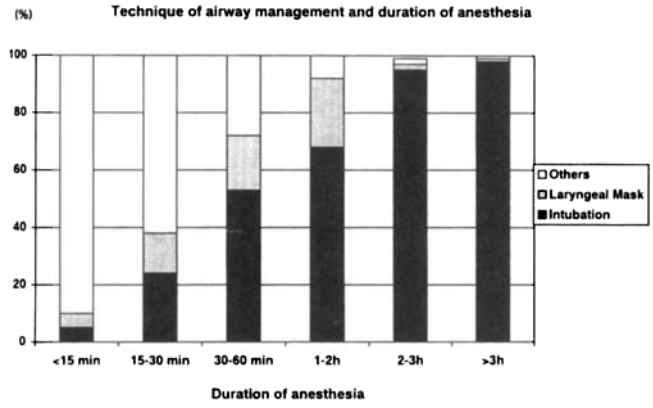

Fig. 4. Use of intubation and laryngeal mask according to the duration of anesthesia.

Epidural block was the most frequent anesthetic technique (96%) used for labor and delivery. With the knowledge of the number of deliveries in the country, the rate of epidural analgesia was calculated as 51 per 100 deliveries. The time between administration of epidural analgesia and delivery was 190 min in 50% of cases and > 6 h and 35 min in 10% of cases. In one third of these cases, epidural anesthesia was started between 6:00 P.M. and 7:00 A.M. The techniques of anesthesia for cesarean sections are listed in table 5.

When anesthesia was required for uterine manipulation or manual removal of placenta, in the absence of a previously sited RA, GA was used in 95% of cases. The median duration of these procedures was 20 min; tra-

Table 4. Duration of Anesthesia and Age of Patients for Different Techniques of General and Regional Anesthesia in Surgery

	Duration of Anesthesia [median (10–90%)] (min)	Age of Patients [median (10–90%)] (yr)
General anesthesia		
Intubation	80 (30–200)	44 (14–74)
Laryngeal mask	40 (20–80)	41 (11–71)
No intubation, no laryngeal mask	20 (10–60)	28 (3–72)
Regional anesthesia (with or without sedation)		
Bier's blocks	45 (29–75)	47 (24–73)
Plexus/nerve blocks	70 (30–135)	48 (22–74)
Intrathecal anesthesia	75 (35–140)	66 (34–85)
Epidural anesthesia	95 (45–195)	54 (28–77)

Table 5. Anesthesia for Cesarean Section: Time of Start of Anesthesia and Techniques of Anesthesia in Elective and Nonelective Cases

	Elective CS (%)	Nonelective CS	
		Not Preceded by Epidural (%)	Preceded by Epidural (%)
Start of anesthesia			
7:00 A.M. to 6:00 P.M.	98	56	51
6:00 P.M. to 0:00 A.M.	2	24	39
0:00 A.M. to 7:00 A.M.	0	20	10
Techniques of anesthesia			
General anesthesia	18	33	16
Regional anesthesia (RA)	82	67	84
Epidural (% of RA)	23	33	97
Intrathecal (% of RA)	73	64	2
Epidural + intrathecal (% of RA)	4	3	1

CS = cesarean section; RA = regional anesthesia.

cheal intubation or laryngeal mask insertion was used in 8% and 4% of these cases, respectively.

Discussion

The main interest of this nationwide survey was to provide an overview of the present activity of anesthesia in a developed industrialized country and to compare it with a previous survey conducted in 1980,[15,16] to identify the trend in anesthesia development. The goal of the current article is to synthesize the results of the larger study, which was recently published in French as an extensive report.[14] The two major findings of this survey were that the practice of anesthesia has both increased and changed over the last 16 yr. Our hypothesis was confirmed that the number of anesthetic procedures had increased more than twofold since 1980, and that the practice of anesthesia had changed. These changes consisted of a marked growth in the number of anesthetic procedures performed in elderly patients, an important development of RA, and a modification in the types of procedures requiring anesthesia.

The methodology used in the present survey offered the advantage of providing a representative sample at a national level. The excellent participation rate and the validation process allowed a representative population sample for analysis. This methodology does not allow comparisons between individual institutions and regions, because the data were collected at different time periods. However, it is likely that the impossibility of making such comparisons had contributed to the high participation rate of anesthesiologists. The unit of measurement in the present survey was one anesthetic in a given patient. Therefore, knowing the total number of the population, it was possible to calculate an annual rate of anesthetic procedures for the population. This number may overestimate the true annual rate of anesthetized patients because some patients may have received several anesthetics during the same year.

The most important finding of this survey concerned the major development in anesthetic activity. Between 1980 and 1996, the number of anesthetic procedures increased by 120%, from 3,600,000 (95% confidence interval, ± 240,000) to 7,937,000 (95% confidence interval, ± 387,000).[15,16] When these results were analyzed and corrected for the increase in the French population (from 53.7 to 58.1 million), they showed that during the same period, the annual rate of anesthetic procedures had increased from 6.6 to 13.5 per 100 population. The rate of anesthetic procedures for the different age groups in the 1980 and 1996 surveys is shown in figure 5. The increase in the number of anes-

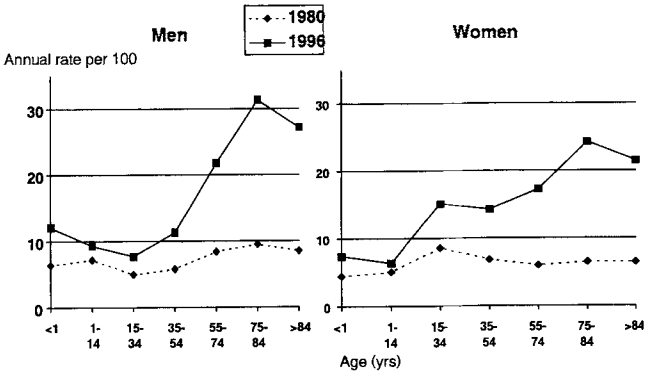

Fig. 5. Annual rate of anesthesia per 100 population within the different age groups from 1980 to 1996.

Table 6. Distribution of Percentage of Anesthetic Activity in Surgery within the Different ASA Classes: comparison 1980–1996

ASA Class	1980 (%)	1996 (%)
1	79.4	60.0
2	14.6	28.3
3	4.9	10.5
4 + 5	1.1	1.2

ASA = American Society of Anesthesiologists.

thetic procedures between 1980 and 1996 concerned all age groups and all ASA classes. However, elderly patients and those with a high ASA score showed the greatest increase (table 6 and fig. 6). The number of anesthetic procedures for patients with an ASA status of 1 increased by 30% between 1980 and 1996, whereas the number of those with an ASA status of 3 increased by 268% during the same period. In addition, during this period, the annual rate of anesthetic procedures also increased in all age groups, with the greatest increases observed in three groups of patients: children aged < 5 yr (+92%), women aged 20–40 yr (+80%), and patients aged > 60 yr (+196%).

These changes in the patient population are important to consider for the determination of the risk of anesthesia. In recent studies related to the risk of anesthesia,[11,12] the number of anesthetics and the distribution of patients within the different ASA classes were not measured. Because the risk of anesthesia is greater in patients with an ASA status of 3,[15,16] the marked increase in the number of anesthetic procedures in these patients observed in the present survey may lead to an overestimation of the risk of anesthesia in the total population and in patients with an ASA status of 1–2.

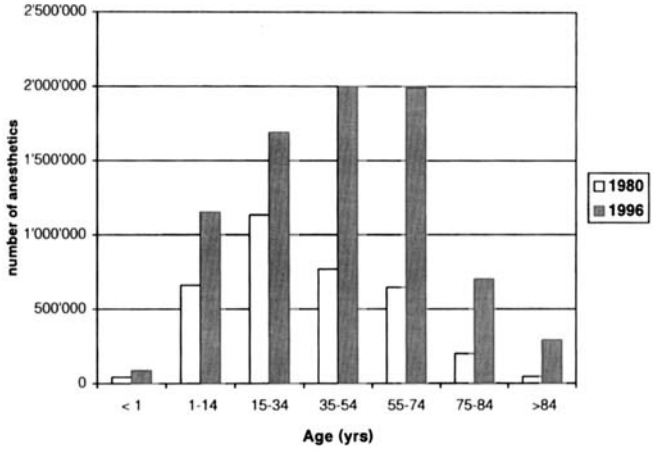

Fig. 6. Distribution of the estimated number of anesthetics within the different age groups from 1980 to 1996.

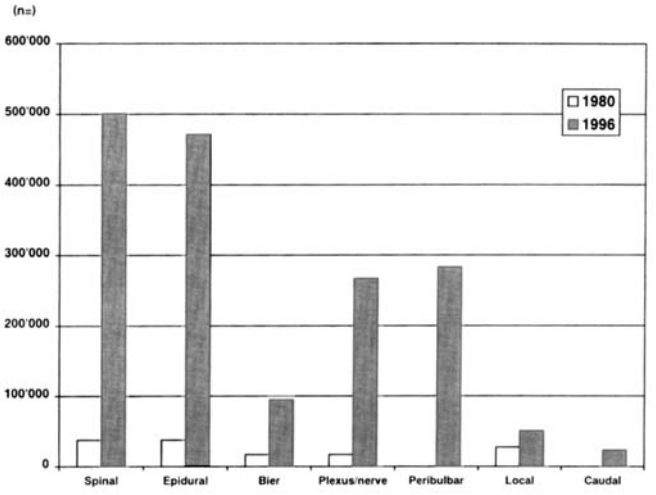

Fig. 7. Evolution in the estimated number of the different techniques of regional anesthesia between 1980 and 1996.

Changes in the Practice of Anesthesia

In addition to the evolution in the number of anesthetic procedures, this survey points out the significant development of RA. These techniques are now used in 23% of all anesthetic procedures and are represented mainly by intrathecal, epidural, peribulbar, and plexus/nerve blocks, by decreasing order of frequency. When compared with the 1980 practice, this evolution represents a 14-fold increase in the number of cases (fig. 7).

Intrathecal and epidural anesthesia are the most frequently used techniques, but their indications are different. Epidural anesthesia is essentially performed for obstetric procedures, and only 16% is used for surgery. Intrathecal anesthesia is primarily used in surgery; it is 15 times more frequently performed in surgery compared with epidural anesthesia. When compared with the 1980 survey, this represents a 10-fold increase in the practice of intrathecal anesthesia. In addition, it is interesting to point out that this technique now involves young patients: 10% of intrathecal anesthesia procedures were performed in patients aged < 34 yr. The increase in the practice of plexus/nerve blocks was also significant: the number of cases increased 16-fold between 1980 and 1996.

General anesthesia has also markedly changed during the last 16 yr. The first major change is related to the methods of airway management, with the introduction of the laryngeal mask, used in 10% of GA in 1996. It was also interesting to identify that 16% of tracheal intuba-

tions were performed without the use of muscle relaxants. The second change concerns the drugs used for GA, as shown by an increase in both opiates (from 55% to 86%) and volatile agents (from 49% to 77%) and a decrease in the use of neuroleptics (from 17% to 3%).

Changes in the Indications for Anesthesia

Because most surgical procedures are performed with anesthesia, this survey also offers the possibility to evaluate the changes in the type of interventions requiring anesthesia. However, this study did not include surgical operations performed under local anesthesia or RA when these techniques were practiced by surgeons, as is the case for some ophthalmologic or plastic surgical procedures, nor did it include gastrointestinal endoscopies performed with sedation administered by gastroenterologists without supervision by anesthesiologists. These factors need to be considered if these results are to be compared with other surveys in which the information related to anesthesia may be lacking.[1]

The number of anesthetic procedures in surgery increased by 84% between 1980 and 1996. However, because the increase in the number of anesthetic procedures was greater for obstetric and other nonsurgical radiologic or endoscopic procedures, surgery only represented 71% of all anesthetic procedures in 1996, whereas 88% of anesthetic procedures were related to surgery in 1980. This points out the fact that although surgeons remain the main partners of anesthetists, obstetricians, radiologists, and gastroenterologists now provide more than one fourth of anesthesia cases.

Between 1980 and 1996, there were marked changes in the evolution of the types and the number of surgical procedures performed with anesthesia (fig. 8). In 1980, the two most frequent surgical anesthetic procedures were performed for orthopedic (20%) and digestive (17%) surgeries,[16] and the number of anesthetic procedures for orthopedic surgery has doubled over the last 16 yr. In contrast, anesthetic activity for digestive surgery remained globally unchanged during this period, with only variations in the type of procedures that were performed. For example, the number of anesthetic procedures for appendectomies decreased during this period by 48%, whereas the number of cholecystectomy cases increased by 47%. The greatest increase in the number of anesthetic procedures was observed for ophthalmologic surgery, which increased 410% between 1980 and 1996, with a sixfold increase in cataract surgery. The evolution of anesthesia for obstetric procedures represents one of the most important developments achieved by anesthesia during this 16-yr period. Epidural anesthesia, which was used in 1.5% of all deliveries performed in France in 1980, was performed in 51% of all deliveries in 1996. In terms of pain relief and comfort for the female population, this must be considered as a major advance that was provided by the development of the anesthetic specialty. In addition, between 1980 and 1996, the number of anesthetic procedures for cesarean sections also doubled. During this period, the use of RA for cesarean sections has increased from 10% to 76%.

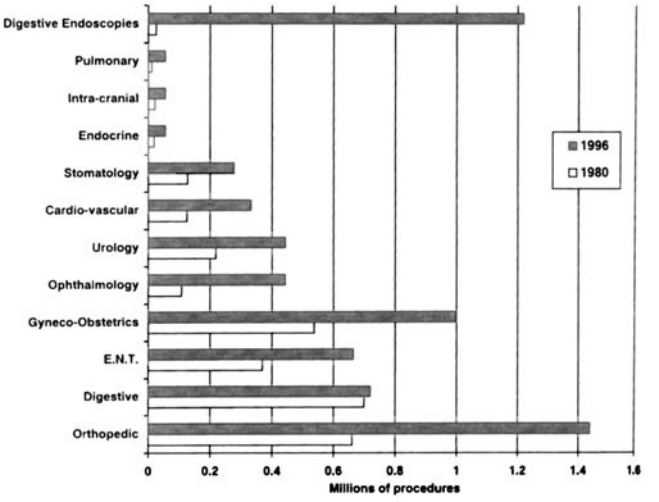

Fig. 8. Evolution in the estimated number of the different procedures performed with anesthesia between 1980 and 1996.

Anesthesia for gastrointestinal endoscopies was the procedure that showed the greatest development, representing, in 1996, 16% of all anesthetics, with a 50-fold increase in comparison to 1980. This marked development of anesthesia for gastrointestinal endoscopies is an evolution that may be specific to the French practice of anesthesiology.

Comparisons between the results of this study and similar surveys conducted in other countries are difficult because all previous surveys concerned surgical procedures and did not analyze anesthetic activities. However, similar trends have been observed, with a continuing increase in the number of procedures.[1,6] Surgical activity increased in the United States by 29% between 1983 and 1994, with similar growths in various types of surgical procedures than in the present survey, such as cataract extraction (+225%) and arthroscopy of the knee (+153%).[1]

In conclusion, the present survey offers an interesting overview of the current activity of anesthesia in a developed industrialized country with a population of 58

million. It points out the significant evolution in the practice of anesthesia in the last 16 yr, with a major increase in the prevalence of anesthesia for elderly patients and for patients with increased risk. It also shows that RA has become a major component of anesthesia practice, especially in obstetrics and orthopedic surgery. The improvement in knowledge of the practice of anesthesia provided by this survey should help the specialty of anesthesia to be more adequately recognized among health providers, policy makers, and patients. This information clearly shows that anesthesia is a significant contributor to the development of surgery and provides for patients' comfort during labor and painful procedures. Knowing the expected continuing growth in the elderly population within the next decades, the present study may help to anticipate the increases in the number of anesthetic procedures that should be associated with these demographic changes.

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Appendix: Example (after translation) of the form sent for the survey to all anesthesiologists

This confidential part has to be torn out and should not be sent to INSERM when completed

Patient identification

" 3 DAYS OF ANESTHESIA IN FRANCE "

SFAR - INSERM

Institution Code <- *filled by INSERM* -> File number

Fill one form for each anesthetic. Mark each corresponding space with the correct answer.

PATIENT Date of birth : | | | | 1 | | | | or, by default, age: | | | yrs

Sex :
1 Male
2 Female

Ambulatory :
1 Yes
2 No

ASA physical status class :
1 Absence of medical disorder other than that indicated by the procedure, no medical disorder
2 Mild medical disorder, in relation or not to the surgical disease
3 Moderate medical disorder, in relation or not to the surgical disease
4 Major medical disorder, associated with an immediate risk of death
5 Moribund Patient

ANESTHESIA Date of the anesthesia : | | | | | 9 6

Programmed : 1 Yes 2 No

Type : 1 GA/Sedation 2 RA

Start of anesthesia : | | H | | min

Exit of intervention room: (or time of delivery) | | H | | min

Induction :
1 Intravenous
2 Inhalation
3 Intramuscular
4 Rectal

1 Intubation
2 Laryngeal Mask
3 Closed circuit

Agent(s) of anesthesia : (excluding premedication)
1 Volatile
2 Opiates
3 Benzodiazepines
4 Hypnotics, (BZD excluded)
5 Muscle relaxants
6 N_2O
7 Neuroleptics

Regional Anesthesia :
1 Spinal anesthesia
2 Lumbar Epidural Anesthesia
3 Plexic Block
4 Bier Block
5 Peribulbar Anesthesia
6 Other Regional Anesth: in clear :

PROCEDURE *Write clearly the procedure(s) carried out :*

Emergency : 1 Yes 2 No

Surgery :
01 Cardiac
02 Digestive
03 Endocrine
04 Gynecology
05 Intra-cranial
06 Maxillo-facial
07 Stomatology
08 Obstetric
09 Ophtalmology
10 E.N.T.
11 Orthopedic
12 Plastic, esthetic
13 Spine
14 Lung
15 Urologic
16 Vascular
17 Other

Endoscopy :
1 Digestive high
2 Digestive low
3 E.N.T.
4 Pneumologic
5 Joint
6 Diagnostic laparoscopy
7 Hysteroscopy
8 Urology
9 Other

Exploration :
1 Vascular Radiology
2 C.T. Scanner
3 M.R.I.
4 Cardiac Cath
5 Other

Particular Procedure :
1 Obstetrical Labor
2 Cesarean Section
3 Retrograde Cholangiography
4 Laparoscopic Surgery
5 Sismotherapy
6 Cardioversion
7 Interventional Radiology
8 Angioplasty
9 Other

Transfusion Strategy :
1 Homolog Transf. RBC | | | Number of units FFP | | |
2 Pre-donation
3 Intra-operative Salvage
4 Intentional preop hemodilution.

form to be sent to: INSERM SC25, 44 chemin de ronde 78110 LE VESINET (Tél: 34 80 24 58, Fax: 34 80 24 29)