

Spine Surgery Profile in the Fourth Age

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Abstract

As the population of the United States undergoes significant qualitative and quantitative changes the health-care needs of the population changes accordingly. Since the “old-old” ≥ 85 years sector of the population is growing fast we embarked on studying how spine surgery profile changes across age groups. **Methods:** A database of 6147 spine surgery patients operated in a tertiary care center in Middle Georgia between 2003 and 2009 was divided to four age groups. The threshold for old-old age was set at 75. The percentage of old-old patients was calculated and their spine surgery profile for the whole period was studied. Changes in spine surgery profile were evaluated in relation to age group and gender. Type of surgery was determined by ICD-9 code. **Results:** For the whole study period, the percentage of old-old spine surgery patients was 6.7%. The percentage of old-old spine surgery patients increased from 4.7% in 2003 to 7.3% in 2009. Females were preponderant in the later three age groups (53.8%, 53.2% and 55.0%) while males were more in the < 40 group (52.8%). Significant differences in the spine surgery profile between age groups were detected ($X^2 = 1446.958$, $P = 0.000$). The spine surgery profile for the whole study period was characterized by shifts in the ≥ 75 age group toward less primary fusions of the cervical and lumbar spine and more refusions of the lumbar spine, more intervertebral disk excisions and more canal exploratory operations in older-old patients. In addition to the age factor, the gender factor had an impact on the spine surgery profile. Statistically significant differences ($P < 0.5$) were noted between males and females in each age group. **Conclusions:** Spine surgery profile shows a tendency toward less invasive procedures in the older-old population unless indicated by previous surgery failures, upper neck injuries or osteoporosis-induced fractures.

Keywords: Spine Surgery, Fourth Age, Very Old, Old-Old, Older-Old

1. Introduction

As the population of the United States undergoes significant qualitative and quantitative changes the health-care needs of the population change accordingly. Latest data (July 2009) show that 307.007 million people live in the United States, 5.722 million of them (July 2008) are 85 years and older, 3.858 million of which are females [1]. While the total population of the United States increased by 0.4 fold over 19 years (from 226.542 million in July 1980), the ≥ 85 age group more than doubled during this period (from 2.271 million in July 1980, **Figure 1**).

The ≥ 85 age group (and in some references ≥ 75) has recently been dubbed “the Fourth Age”, “the very old”, or “the old(er)-old” [2-5]. Since the senior sector of the

Western population is growing rapidly, owing to better healthcare services and improved longevity, we attempted to study the spine surgery profile of this patient population compared with other age groups.

2. Materials & Methods

A database of 6147 spine surgery patients operated in a tertiary care center in Middle Georgia between 2003 and 2009 was divided per age. Four age groups were demarcated and the threshold for old-old group was set at 75 [6,7]. Some references use 80 or 85 years as a threshold, pointing to lack of consensus on the definition of this new terminology [5,8,9].

The percentage of old-old patients was calculated and their spine surgery profile for the whole period was

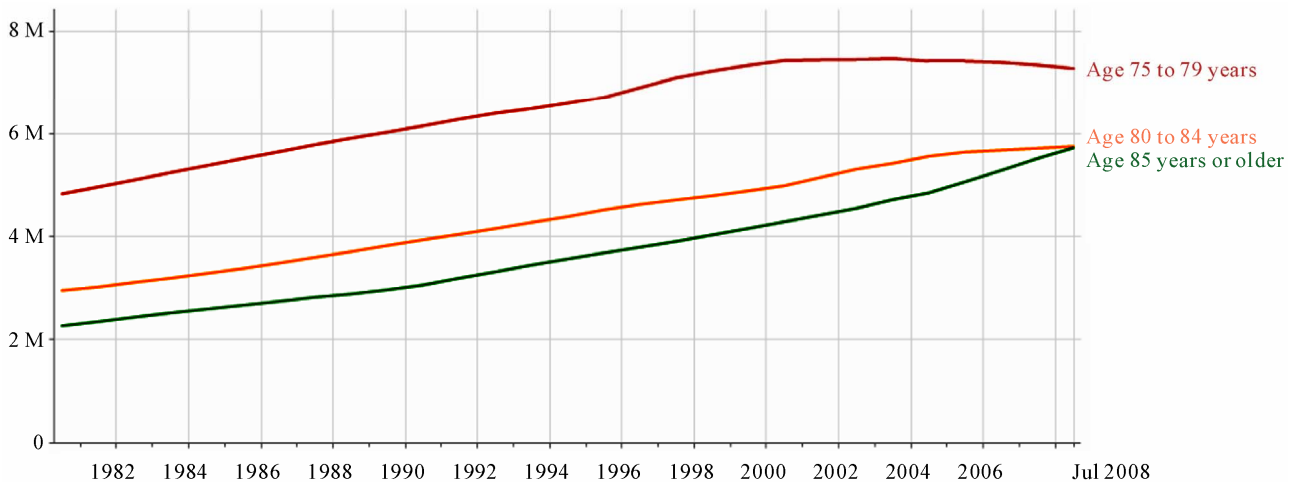


Figure 1. Growth of the U.S. senior population. Data source: U.S. Census Bureau. Graph source: Google public data explorer.

studied. Spine surgery profile for a cohort of patients was defined as the distribution of spine surgical interventions for the named cohort per type of procedure. Changes in spine surgery profile were studied in relation to age group and gender. Type of surgery was determined by ICD-9 code. Percentages were statistically compared using Pearson Chi-square analysis.

3. Results

3.1. Growing Old-Old Percentage

For the whole study period, the largest group (51.1%) was the 40 - 59 age group. The percentage of old-old spine surgery patients (≥ 75 years old) was 6.7% (Figure 2). Over the years, the percentage of old-old spine surgery patients increased from 4.7% in 2003 to 7.3% in 2009. Females were preponderant in the later three age groups (53.8%, 53.2% and 55.0%) while males were more in the <40 group (52.8%).

3.2. Summated Spine Surgery Profile

In the whole cohort for the whole study period, the top five surgical procedures were:

- Anterior cervical decompression and fusion (40.7%).
- Lumbar/Lumbosacral fusion, lateral approach (19.2%).
- Excision of intervertebral disk (15.0%).
- Spinal canal exploration (8.3%).
- Lumbar/Lumbosacral fusion, posterior approach (5.7%).

3.3. Spine Surgery Profile across Age

Significant differences in the spine surgery profile be-

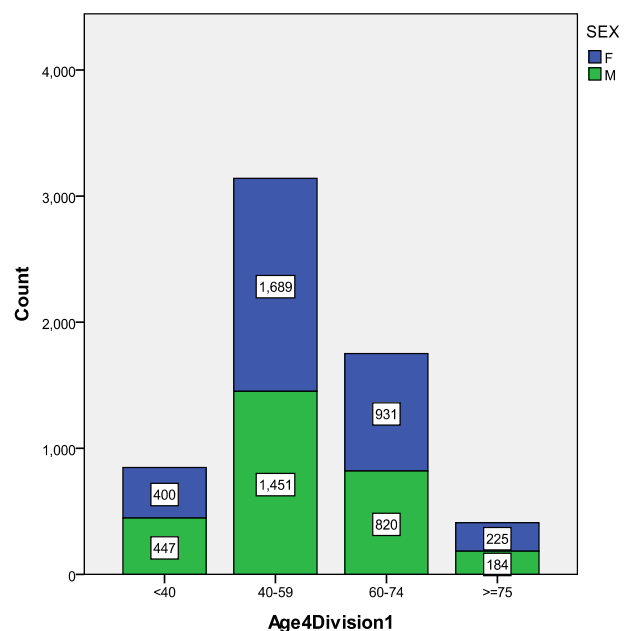


Figure 2. Patient database divided per age group and gender.

tween age groups were detected ($X^2 = 1446.958$, $P = 0.000$). The spine surgery profile of the ≥ 75 age group was characterized by a relative increase in the following procedures:

- Spinal canal exploration (from 3.1% in patients <40 to 26.7% in patients ≥ 75).
- Insertion or replacement of interspinous device (from 0.4% in patients <40 to 26.8% in patients ≥ 75).
- Excision of intervertebral disk (from 17.8% in patients <40 to 23.7% in patients ≥ 75).
- Implantation of interspinous process decompression device (from 0.0% in patients <40 to 3.9% in patients

≥75).

- Vertebral fracture repair (from 1.7% in patients <40 to 2.7% in patients ≥75).
- Atlas-axis fusions (from 0.5% in patients <40 to 1.2% in patients ≥75).
- Reopening laminectomy site (from 0.0% in patients <40 to 0.5% in patients ≥75).
- Refusion of lumbar, lateral or posterior (from 0.0% in patients <40 to 0.5% in patients ≥75).

On the other hand, the following procedures relatively decreased in the ≥75 age group:

- Anterior cervical fusion (from 36.0% in patients <40 to 14.7% in patients ≥75).
- Lumbar and lumbosacral fusions, lateral (from 17.1% in patients <40 to 7.8% in patients ≥75).
- Lumbar and lumbosacral fusions, posterior (from 6.4% in patients <40 to 5.1% in patients ≥75).

- Dorsal/dorsolumbar fusion, posterior (from 5.3% in patients <40 to 1.2% in patients ≥75).
- Spinal structure repair (from 3.5% in patients <40 to 0.2% in patients ≥75).
- Dorsal/dorsolumbar and lumbar/lumbosacral fusions, anterior (from 0.7% in patients <40 to 0.0% in patients ≥75).

Summarizing the above-mentioned trends, it is evident that the spine surgery profile changes toward less primary fusions of the cervical and lumbar spine and more refusions of the lumbar spine, more intervertebral disk excisions and more canal exploratory operations in older-old patients (Figure 3).

In addition to the age factor, the gender factor has an impact on the spine surgery profile. Statistically significant differences (P < 0.5) were noted between males and females in each age group (Figure 4). Older-old female

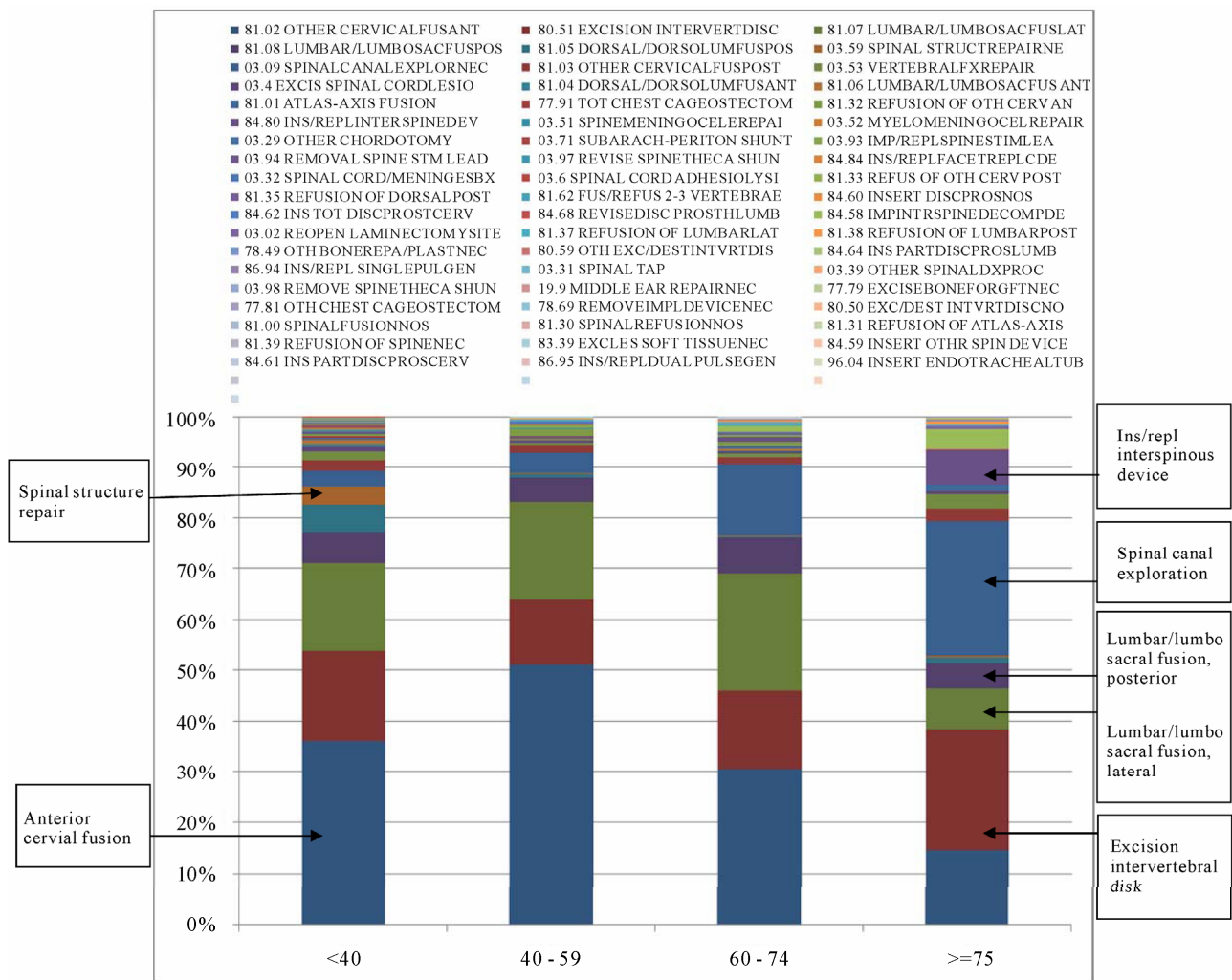


Figure 3. Spine surgery profile for a database of spine surgery patients divided per age group. Procedures in the <40 group sorted in descending order.

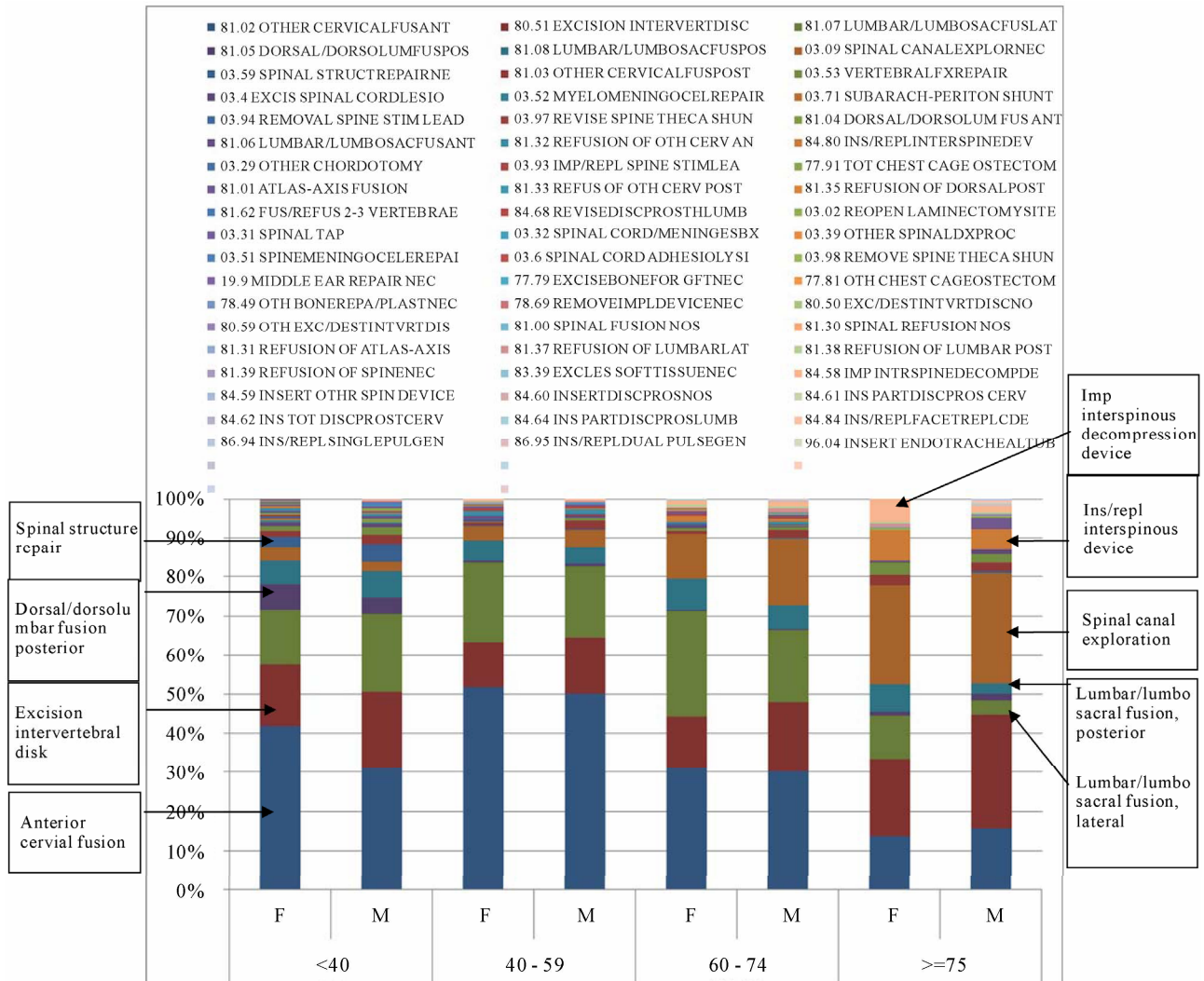


Figure 4. Spine surgery profile for a database of spine surgery patients divided per age group and gender. Procedures in the <40 female group sorted in descending order.

patients had more lumbar fusions (11.1% vs. 3.8 for lateral; 7.1% vs. 2.7% for posterior), more interspinous devices (8.0% vs. 5.4%) and more vertebral fracture repairs (3.1% vs. 2.2%). Older-old female patients had fewer excisions of intervertebral disks (19.6% vs. 28.8%) and less canal exploratory operations (25.3% vs. 28.3%).

4. Commentary

Aging has always been synonymous in the traditional people’s imagination with decreased functionality, increasing pain, fear of disability and impending death [10]. Current developments in technology and surgery have to some extent challenged this concept by extending length of human life and improving quality of everyday living. The share of the old-old is expected to grow twice as fast as the conventional old group in the coming decades [10].

This qualitative change in the population’s composition is accompanied by a parallel increase in demand for healthcare services related to degenerative and chronic diseases, including degenerative spine disease and chronic back pain.

The old-old subgroup of the senior population presents their own needs as their functional reserves rapidly decline and the capacity to self-repair becomes extremely impaired. The demand for spine surgery in the old-old is therefore characterized by higher requirement for explorative decompressive interventions with the least possible trauma. Decompressive procedures are less invasive than fusion procedures and are mostly done through laminectomy and less frequently with the help of an interspinous device. Other types of fusions that increase in the older-old are refusion procedures performed to correct complications, namely pseudoarthrosis, resulting

from previous fusion attempts. Atlas-axis fusions also increase in older-old patients due to a comparatively elevated risk of upper cervical spine injuries in elderly patients [11]. Female old-old patients unsurprisingly present with higher frequency of vertebral fracture accidents and therefore require more such repairs due to higher prevalence of osteoporosis [7]. The relatively higher occurrence of dorsal/dorsolumbar fusions and spine structure repair operations in the <40 age group could be related to more frequent traumatic and congenital etiology in younger age. The preponderance of females patients in the later three age groups and males in the younger group reflects the fact that younger males are subject to suffer more professional spine injuries while females have better longevity and the longer they live the higher the risk of osteoporosis.

In summary, the spine surgery profile of our patients shows a tendency toward less invasive procedures in the older-old population unless indicated by previous surgery failures, upper neck injuries or osteoporosis-induced fractures.

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