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The Impact of a Hospitalist Model in Perioperative Care of Elective Joint Replacement Patients: a 17 years-experience Report

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Research article

Keywords: Hospital lengths of stay (LOS), 30-days readmission rate, incidence of prosthetic joint infections (PJI) and patient related co-morbidities, number of medico-legal disputes and related costs, medical customer satisfaction.

Posted Date: August 5th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-32160/v2

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Abstract

Background: Hospitalists are physicians whose primary professional focus is the general medical care of hospitalized patients. The aim of this report is to describe a 17-year experience of a hospitalist model in peri-operative co-management in more than 25000 elective joint replacement patients.

Methods: A retrospective observational study about surgical co-management with hospitalists in a tertiary teaching referral hospital in Milan in relation to hospital lengths of stay (LOS), 30-days readmission rate, incidence of prosthetic joint infections (PJI) and patient related co-morbidities, number of medico-legal disputes and related costs, and medical customer satisfaction.

Results: Over a 17-year period LOS has been reduced from 10 to 5 days; readmission rates at 30 days for total hip arthroplasty are 1.7% vs 3.7% (Italy), whereas for total knee arthroplasty are 0.8% vs 1.4% (Italy); total infection rates (PJI) are recorded at 0.7% vs 1.4% (Italy); obesity, diabetes, cardiovascular diseases and chronic obstructive pulmonary disease (COPD) and/or smoking result as the main co-morbidity in PJI; there have been only 113 medico-legal disputes out of approximately 19000 surgeries and we report 95% overall medical customer satisfaction.

Conclusions: This is the first paper outside the US to highlight the impact of the hospitalists on patient satisfaction and the translation of the obtained benefits into savings. The evolution of the hospitalist model in surgical settings shows promising results in terms of patients' safety and cut of health-related direct and indirect costs.

Background

Surgical co-management with hospitalists is a 20-year reality in the US. In 1999, Freese[1] described the first "hospitalist" system, developed at Park Nicollet Clinic in 1993 (Minneapolis, Minnesota) where internists and family practitioners were given the opportunity to merge in a totally office based multispecialty group with the objective to reach a good patient acceptance along with increased physician satisfaction. Additionally, Wacther and Goldman[2] in 1996 described the importance of efficient care by managed-care organizations for a proper use of resources for inpatients. They established a new breed of physicians called "hospitalists" - specialists in inpatient medicine – responsible for managing the care of hospitalized patients in the same way that primary care physicians are responsible for managing the care of outpatients. The National Association of Inpatient Physicians (NAIP), the society representing hospitalists, proposed a definition in 1999: "Hospitalists are physicians whose primary professional focus is the general medical care of hospitalized patients. Their activities include patient care, teaching, research, and leadership related to hospital care." The hospitalists' involvement in the care of different kind of surgical patients during the preoperative and postoperative phases allows the surgeon to be in the operating room all day ensuring at the same time appropriate care to the patient on the ward. A milestone in describing the hospitalist figure with his or her roles and potential activities is again thanks

to Wachter[3] who demonstrated a stunning approximate saving of $2.2 billion per year due to hospitalist care in US.

The first published paper that focused on elective hip and knee arthroplasty dates back to 2004 by Huddleston and colleagues[4]. An interesting review focused on outcomes and quality measures comparing hospitalists with non-hospitalists cared patients is attributed to Peterson[5] in 2009. More recently, in 2016 Duplantier et al.[6] compared postoperative medical co-management of total hip and knee arthroplasty patients using a hospitalist and non-hospitalist model although controversially with no significant outcome differences. A proof of important cost savings related to this co-management model in orthopaedic and neurosurgical patients is due to the work of Rohatgi and co-workers[7] in 2016. These data are confirmed in 2018 by Fitzgerald et al.[8]. Finally, we describe our 17 years of experience in the peri-operative co-management together with Anaesthesiologists and Orthopaedics of more than 25000 elective joint replacement patients confirming the high quality impact of Hospitalist approach.

Methods

A retrospective observational study was carried out in relation to the Italian national register of high-volume orthopaedic surgery hospitals (over 300 arthroplaties/year) and considered the following criteria: hospital lengths of stay (LOS) and 30-days readmission rate for any medical reason in the last 5 years, whereas we were able to collect data in the last 10 years regarding incidence of prosthetic joint infections (PJI) and patients related co-morbidities in PJI, number of medico-legal disputes and related costs, and medical customer satisfaction.

Results

LOS was reduced from 10 days between 2003 and 2012, to 7 days between 2013 and 2016, to 5 days after 2017 with the implementation of the rapid recovery program together with our Anaesthesiologist team and Rehabilitation Department (Table 1).

Table 1

Length of stay in hospital (LOS)

2003-2012	2013-2016	2017-2019
9600 patients	8300 patients	8900 patients
10 days	7 days	5 days

Our 30-days readmission rate (2015-2019, approximately 14000 patients in our Hospital) for total hip arthroplasty (THA) is recorded as 1.7% vs high volume hospitals in Italy (>300 arthroplasties/year) 3.2% vs Italy national mean 3.7%. Considering total knee arthroplasty (TKA) we recorded 0.8% vs high volume hospitals in Italy 1.3% vs Italy national mean 1.4% (Table 2).

Table 2

30-days readmission rate 2015-2019 (14000 patients)
Total Hip Arthroplasty (THA), Total Knee Arthroplasty (TKA), Istituto Clinico Humanitas (ICH), High Volume (>300/year) Arthroplasty Hospitals (HVAH), Italy Overall Mean (IOM)

	ICH	HVAH	IOM
THA	1.7%	3.2%	3.7%
TKA	0.8%	1.3%	1.4%

Concerning infections in our hospital, the total infection rate results as approximately 2% and the PJI accounts for 0.8% of total arthroplasties in the index period. Further to this, in 2009 a 0.7% of PJI was reported but we observed a rise to 1.2% in 2010. As a result, our antibiotic prophylaxis approach changed (duration, timing, dosage) and starting from 2011 we obtained a statistically significant reduction (P=0.01) to 0.4%, and maintained this figure in 2012 (0.4%), in 2013 the figure was (0.5%), stabilizing to a mean of 0.7% over the past 11 years (Table 3).

Table 3

Overall Prosthetic Joint Infections (PJI) data. Total Hip Arthroplasty (THA), Total Knee Arthroplasty (TKA), TOT PJI (total PJI treated, referred + internal), ICH PJI (PJI related to our surgeries)

YEAR	THA+TKA	PJI	TOT PJI	ICH PJI
2009	1323	18	1.4%	0.7%
2010	1331	36	2.9%	1.2%
2011	1356	33	2.4%	0.4%
2012	1360	35	2.7%	0.4%
2013	1471	31	2.1%	0.5%
2014	1983	25	1.2%	0.8%
2015	2361	29	1.3%	0.8%
2016	2514	49	2.0%	1.4%
2017	2900	44	1.6%	0.6%
2018	2963	84	2.8%	0.8%
2019	3045	106	3.4%	0.4%

Considering patients co-morbidities in PJI, we observed the following: obesity 46.2%, diabetes 34.6%, cardiovascular diseases 34.6%, COPD/smoking 26.9%, renal insufficiency 19.2%, autoimmune diseases 19.2%, previous malignancy 15.4%, liver diseases 11.5% (Table 4).

Table 4

Prosthetic joint infections (PJI) risk factors

NO RISK FACTORS	11.5%
OBESITY	46.2%
DIABETES	34.6%
CARDIOVASCULAR DISEASES	34.6%
COPD/SMOKING	26.9%
RENAL INSUFFICIENCY	19.2%
AUTOIMMUNE DISEASES	19.2%
PREVIOUS MALIGNANCIES	15.4%
LIVER CHRONIC DISEASES	11.5%

As for the number and type of medical consultations they resulted as episodic, mainly due to cardiology (only for postoperative persistent atrial fibrillation or myocardial infarction), neurology (postoperative stroke) and infectious diseases (up to 2017, because an infectious disease specialist joined our team 2 years ago), whereas we don't need any other internist consultation.

Finally, the number of medico-legal disputes and related costs are recorded at 113 out of approximately 19000 surgeries over the last 10 years (0.6%).

In our hospital we distribute an anonymous survey with questions related to all the hospital journey starting from the pre-hospitalisation up to discharge: the overall medical customer satisfaction is 95%.

Discussion

In Minneapolis in 1993, Freese[1] described the first experience in the use of physician specialists in inpatient medicine.

In 1996, Wacther and Goldman[2] underlined the importance of hospitalists in efficient care for a proper use of resources for inpatients: as hospital stays become shorter and inpatient care becomes more intensive, a greater premium will be placed on the skills, experience, and availability of physicians caring for inpatients with the ability to respond quickly to changes in patient's conditions. In an academic setting, hospitalists provide a premium on clinical quality improvement, in the development of practice guidelines, and outcome research.

Wachter[3] in 2002 reviewed the Literature on the evolution of the hospitalist model in the US underlying the significant decrease in hospital LOS and costs savings, accounting at that time (calculated on the US 4500 hospitalist base) for a stunning $2.2 billion per year. In fact, with more than 30000 hospitalist staff approximately 70% of US hospitals that number should be multiplied by 6 ($13 billion). Moreover, Wachter described the core and potential additional activities for hospitalists.

The first published paper that focused on surgical co-management with hospitalist in elective hip and knee arthroplasty dates back to 2004. Huddleston and colleagues[4] demonstrated that more patients in the hospitalist group were discharged from the hospital with no complications (61.6% vs. 49.8%), fewer minor complications were observed among hospitalist patients (30.2% vs. 44.3%), and mean length of stay for patients in the hospitalist model of care was shorter (5.1 days vs. 5.6 days). Although total costs did not differ between groups, orthopaedic surgeons and nurses preferred the hospitalist model.

The first review of outcomes and quality measures comparing hospitalists with non-hospitalists cared patients is thanks to Peterson[5] in 2009 including orthopaedic surgery, pneumonia and heart failure. The author showed that the inpatient care by hospitalists leads to decreased hospital cost and LOS. Hospitalist care was also reported to improve several measures of care: orthopaedic surgery patients had a shorter time related to surgery, consultation, and hospital LOS. Hospitalists have more practice and

experience tending to inpatient medical problems than the so-called disease-specific physician experience.

Rohatgi and co-workers[7] firstly demonstrated in 2016 a significant savings estimate of $2600-4300 per patient in a cohort of orthopaedic and neurosurgical patients. Surgical co-management with hospitalists was associated with a significant differential decrease in the proportion of patients with at least one medical complication after surgery (*P=0.008*), the reduction of LOS (*P<0.001*) and of 30-days readmission rate for medical reasons (*P<0.001*), and the reduction of medical consultations (*P<0.001*). The overall patient satisfaction was elevated (88.3%).

On the contrary, Duplantier et al.[6] (2016) retrospectively compared postoperative medical co-management of total hip and knee arthroplasty patients using a hospitalist (H, 1656 patients) and non-hospitalist model (NH, 1319 patients), and showed decreased LOS (*P<0.001*) in H group, but a total rise in direct costs due to a greater number of tests ordered (*P<0.001*) resulting in more new diagnosis (*P<0.001*) and with higher costs of hospitalization (*P=0.002*); no differences were seen in readmission rates.

In 2018, Fitzgerald et al.[8] studied 1100 patients before and after Hospitalist-Orthopaedic Co-management submitted to TKR or THA showing statistically significant improvements in multiple performance and quality metrics: reduction of mean LOS (from 3.36 to 3.17 days), increase in percentage of patients discharged at home (from 53.9% to 59% with reduction of unnecessary resource utilization over the episode of care), decrease in medical complications rate (*P<0.05*), and 30-days readmission rate (*P<0.05*), improved rescue and understanding about the needs of surgical patients, increased collaboration between surgeon and hospitalist and anaesthesiologist, avoiding unnecessary testing resulting in better costs control.

Consequently, we describe our 17 years of experience in more than 25000 elective prosthetic joint replacements. The data become more accurate in the last 10 years due to the implementation of electronic chard and database, consequently the analysis is focused on that period (more than 19000 patients).

In Lombardy (Milan Region of Italy), orthopaedic patients account for about 15% of total medical claims for damages with a mean of reimbursement of 60000 euro (SD 99000 euro). More in detail, 54% are related to surgical errors, 10% to diagnostic mistakes and 9% to infections and therapy errors each. In our hospital the total infection rate is about 2% and the PJI accounts for 0.7% of total arthroplasties in the index period. More precisely, in 2009 we had 0.7% of PJI, but we observed a rise of 1.2% in 2010 and our antibiotic prophylaxis approach (duration, timing, dosage) was changed. From 2011 we obtained a statistically significant reduction (P=0.01) to 0.4%, and maintained 0.4% in 2012 and 0.5% in 2013, stabilizing to a mean of 0.7% in the last 11 years (Table 3). This excellent result is probably also due to the presence in our hospital of two hospitalists focused and expert in PJI prevention and treatment. The overall medical claims for damages is approximately 0.6%, far below our national standard average of 10% for major orthopaedic procedures, accounting for about 120 million euro saved in the last 10 years.

The gradual implementation of the rapid recovery program together with anaesthesiologists, orthopaedics and physiotherapists allows us to obtain a progressive reduction of LOS from 10 to 5 days in the index period with a mean cost per day of hospitalization of 400 euro per patient, accounting for a total of about 17.5 million euro saved between 2013 and 2019 (Table 1). The 30-day readmission rate for any medical/surgical reasons in THA is 1.7% (much less than the 3.2% of high volume hospitals in Italy and 3.7% of the Italian national mean). We obtain the same very good results for TKA: 0.8% vs 1.3% of high volume hospitals in Italy and 1.4% of Italian national mean (Table 2). External medical consultations are episodic, mainly due to cardiology, neurology and infectious disease specialists (none in the last 2 years as an ID specialist joined our team). The overall patient satisfaction is very high and rates at 95%. These very good results are related to a strict relevance to evidence-based and internal protocols in patient management starting from the pre-hospitalization through the hospitalization period (ward, surgical theatre, rehabilitation) until the discharge at home. In this patient care management continuum, the hospitalist figure plays a leading role due to the 360 degrees medical outlook of an internist. In our reality we are able to confirm that orthopaedic surgeons, anaesthesiologists and nurses appreciate the hospitalist model for different reasons: firstly, both orthopaedics and anaesthesiologists can be more focused on the operating theatre relying on the presence of an experienced internist to take care of their ward patients; secondly nurses can count on the permanent presence of a referral doctor. Hospitalists provide more efficient, less costly inpatient care with higher quality, reducing LOS, readmissions and in-hospital mortality, due to their ability to manage complex patients themselves both in acute postoperative complications and in chronic co-morbidities, minimizing use of other specialists' consultations.

This study has some limitations: first, it is a retrospective study from a single teaching institution; second, our data has become more accurate in the last 5 to 10 years due to the implementation of computerized data storage. Our study also has some strengths: to our knowledge, it is the paper with the biggest number of patients followed by hospitalists over a long period of time (17 years) demonstrating the great importance of such a new specialization for internists. Moreover, this is the first paper considering the cost savings related to a significant decrease in medical claims thanks to the hospitalist figure.

Conclusions

Our study clearly demonstrate the great importance of the permanent integration of internal medicine specialists in most of the surgical fields of the modern medicine focused on patient care management continuum. Hospitalists are able to provide more efficient, less costly inpatient care with higher quality, reducing LOS, readmissions and in-hospital mortality, as well as PJI decrease and significant reduction in medico-legal disputes and related costs.

Abbreviations

Hospital lengths of stay (LOS), prosthetic joint infections (PJI), total hip arthroplasty (THA), total knee arthroplasty (TKA), chronic obstructive pulmonary disease (COPD)

Declarations

Ethics approval and consent to participate: our Ethical Committee (Comitato Etico Indipendente Istituto Clinico Humanitas) was noticed about the study and all the patients as well as the Ethical Committee gave their consent to the study.

Consent for publication: not applicable

Availability of data and materials: all data reported in the present study are available in our database

Competing interests: no conflicts exist for any of the authors

Funding: not applicable

Authors' contributions:All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by MCF and EA. The first draft of the manuscript was written by MCF and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Acknowledgements: not applicable

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