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Howling at the moon? The effect of lunar phases on post-surgical pain outcome

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Abstract

Objective: Many people are convinced that lunar phases influence their lives – despite the fact that a lot of studies have shown that this belief is wrong. In this article, we investigate the effect of lunar phases on acute post-surgical pain and on treatment-related side effects. We hypothesize that there is no influence.

Methods: The data for the study were collected in 2010 and 2011 in 10 international hospitals participating in the research project PAIN OUT. Hospitalized patients were asked for their pain after surgery and pain treatment side effects using numerical ratings scales from 0 to 10. We applied Kurskal–Wallis H-tests to find out if the four moon phases show significant differences in 14 outcome variables. Afterwards, we adjusted for age, gender and three tracer surgeries.

Results: A total of 12,224 patient data sets were assessed. For most variables and sub-groups, there is no lunar effect on the observed outcome variables. The only items that show statistically significant differences are pain interference with sleep ($p = 0.01$) and drowsiness ($p = 0.01$). The only sub-groups that show statistically significant connections to lunar phases in some variables are men (7 out of 14 variables significant) and elderly people (4 out of 14 variables significant).

Discussion: Even in the statistically significant sub-groups, the differences are small and only show up in some variables. We conclude that lunar phases have no effect on post-surgical pain or its side effects. The hypothesis holds. Thus, there is no reason for patients to postpone surgeries or to fear surgeries on any given date.

Keywords

Post-operative pain, acute pain, lunar phases, moon phases, surgery outcome, pain side effects

Introduction

Astrology is a very old part of mankind's search for truths and answers. It is believed that the position of planets, moons and stars influences life to a certain degree and that it allows for predictions of events. In this article, we determine the influence of Earth's moon on the outcome of surgeries.

In some parts of society, it is a popular belief that our closest orb directly affects the everyday life of people. In order to assess these effects, numerous studies have been undertaken. These studies can be divided up into four major groups: investigations on forensic effects (e.g. violence and crime[1]), on behavioural effects (e.g. alcohol intake[2] and suicide[3]), on effects on women in particular (e.g. frequency of births[4] and spontaneous abortions[5]) and on medical effects in general (e.g. myocardial infarctions[6] and surgical mortality[7]). Although nearly all relevant studies show that no

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effects can be attributed to the different lunar phases, public interest in literature on the moon's impact is persistently high and many people still believe in correlations or even causality between the moon and their personal lives.

One of the fields that are believed to be influenced by the moon is medicine. Holzheimer stated that over 10% of the German population believe in the effects of lunar phases on disease[8] and Vance wrote that 40% of clinical staff think that moon phases influence human behavior.[9] The specific parts of medicine we are looking at in this article are surgeries. Here, it is believed that the days of new moon and full moon are worst for undergoing surgery. Worst means that the mortality and the chance of complications rises, that patients have more pain and side effects and that the need for repeated surgery increases. Paungger and Poppe write that 'For surgical interventions of any kind – apart from emergencies – it holds that the closer to full moon the worse. The day of full moon is worst. If one has a choice, one should operate during the waning moon phase'.[10] However, almost every single study researching moon phase influence on surgery outcome revealed no measurable effects, for example, on post-operative nausea and vomiting,[11,12] mortality of lung cancer surgery,[7] radical cystectomy,[13] total hip arthroplasty[14] or complications in general.[8]

In this article, we investigate the effects of lunar phases on a specific part of post-surgical outcome. We concentrate on post-surgical pain and its psychological impact but also look at side effects of pain treatment. To the best of our knowledge, these outcomes have not been subject to such research yet. Our hypothesis is that the lunar phase has no effect on these surgical outcomes.

Materials and methods

This study used retrospective data that originate from the PAIN OUT project (Improvement in Post-operative Pain Outcome, www.pain-out.eu, short: PO), a research project funded within the 7th Framework Programme of the European Commission. PO was approved by the Institutional Review Board (IRB) of the University Hospital Jena. Informed consent was obtained from all subjects.

In PO, hospitalized patients are included if they are 18 years or older and are willing and able to fill in a validated outcome questionnaire[15] on the first day after surgery. Besides some other items, this outcome questionnaire includes questions for pain scores (maximal and minimal pain, time in severe pain and pain relief), pain interference (with activities in bed and sleeping), psychological impairments due to pain (anxiety and helplessness), side effects of pain treatment (nausea, drowsiness and dizziness), satisfaction with pain treatment, the wish for more pain treatment and the use of non-medical methods (e.g. cold packs, prayer and distraction by watching TV). Apart from the last three mentioned, all these items are answered by ticking a Numeric Rating Scale (NRS) with discrete values from 0 ('no', 'never') to 10 ('worst', 'all the time').[16] Satisfaction with pain treatment is the only scale that is reversed as 0 means 'not satisfied' and 10 means 'completely satisfied'. The questions for the wish for more pain treatment and the use of non-medical methods are answered with yes or no. In this article, we want to observe all of these surgery outcome items. Besides patient reported surgery outcomes, further data are collected in PO on demographics (age, gender, birth country, weight, height and questionnaire language), surgery types and time, comorbidities, and analgesics (surgery phase, route, type and dosage). After the data are collected, it is inputted into a registry using a web mask. In the registry, the patient data are anonymized.

PO is an international project with over 50 participating hospitals worldwide and 25,000 patient data sets (February 2012). For this article, we selected the 10 hospitals with most data sets in order to decrease site-specific variation. These hospitals are located in Germany, Spain, Italy, France, United Kingdom, Sweden, Romania, Israel and Switzerland. All participants were given approval for the PO study by their respective review boards/ethics committees. The data used for this article were obtained in the years 2010 and 2011.

In order to investigate the effect of the moon phases on surgery outcomes, we retrospectively grouped patients according to their surgery date. Four groups were defined that reflect the four main lunar phases in 2010 and 2011: new moon day, first phase (waxing phase), full moon day and last phase (waning phase). This means that the waxing and waning phases cover around 2 weeks, respectively, while the new moon day and full moon day are just 1 day each.

We used IBM Statistics SPSS 19.0.2 for the statistical analysis. In order to test if there are differences between the four lunar phases, we applied the non-parametric Kruskal–Wallis H-test with pairwise exclusions and a significance level of $p < 0.05$ to all NRS items. This test compares the mean ranks of an item in each phase. Applying one-way analysis of variance (ANOVA) instead of mean rank comparison was not possible because it requests a normal distribution of the target item data. None of the items we discuss is normally distributed as proven by a Kolmogorov–Smirnov test. The two items with binary (yes/no) answers were tested for differences using a Pearson's chi-square test. First, we tested the complete patient group. Then, we compared for the pain-specific co-variables gender and age.[17] We used the mean age as border between young and old patients. At last, we tried to decrease variability

Table 1. Results of statistical tests.

Item	All included	Female	Male	Age <= 55	Age > 55	Total hip replacement	Total knee replacement	Laparoscopic cholecystectomy
Number of smallest group	298	158	140	155	142	20	12	16
Number of largest group	5334	2671	2677	2730	2611	395	304	292
Number of item with least number of answers	10,584	5276	5276	5235	5287	741	544	546
Number of item with most number of answers	11,412	5741	5634	5770	5574	785	613	576
Least pain	.064	.488	.010	.441	.104	.730	.197	.331
Worst pain	.058	.139	.017	.668	.036	.960	.910	.483
Time in severe pain	.147	.019	.077	.507	.207	.187	.066	.362
Pain interference with in-bed activities	.227	.205	.272	.647	.157	.148	.745	.072
Pain interference with sleep	.012	.145	.019	.341	.017	.270	.369	.672
Feeling anxious	.332	.682	.009	.347	.396	.589	.822	.958
Feeling helpless	.211	.663	.153	.923	.241	.971	.904	.420
Side effect nausea	.077	.091	.032	.769	.046	.474	.542	.263
Side effect drowsiness	.013	.501	.003	.341	.048	.207	.241	.141
Side effect dizziness	.122	.599	.031	.806	.129	.476	.931	.160
Pain relief	.087	.065	.107	.271	.151	.961	.855	.510
Satisfaction with pain treatment	.324	.675	.187	.841	.262	.053	.220	.126
Use of non-medical methods	.843	.685	.994	.691	.963	.153	.638	.906
Wish for more pain treatment	.754	.543	.079	.557	.502	.777	.497	.763
Number of significant items out of 14	2	1	7	0	4	0	0	0

Shaded cells indicate the only tests with statistical significance.

by looking at the three most frequent surgeries in the PO registry.

Results

In PO, 16,453 patients were screened in the 10 hospitals in 2010 and 2011. Of these, 12,224 (74.3%) were included; 49.2% of the included patients were male. The mean age was 55.3 ± 17.4 years. The five most frequent surgeries were total hip replacement (N = 859), total knee replacement (N = 681), laparoscopic cholecystectomy (N = 668), other exploration and decompression of spinal canal (N = 305), and knee arthroscopy (N = 233).

Table 1 shows the results of the statistical tests for each item. The first column presents the results for all patients. The next columns give the test significances for the following patient sub-groups: female and male patients, patients below the mean age and above the mean age, and the three most frequent surgeries. Not every patient answered every question/item. The different moon phases thus have different numbers per item. For each patient sub-group, Table 1 thus also presents the N of the smallest and largest phase and the minimal and maximal N of each item. In the last row in Table 1, the number of significant moon phase differences per patient sub-group can be seen.

For all patients, only pain interference with sleep and drowsiness show significant differences between moon phases. For the group of items without significant differences, Table 2 exemplarily shows results for maximal pain and the side effect nausea. For each lunar phase, the number of answers, the mean rank and the mean on

Table 2. Results for maximal pain and side effect nausea.

Phase	Maximal pain			Side effect nausea		
	N	Mean rank	Mean	N	Mean rank	Mean
New moon day	330	5821	5.42	329	5570	1.68
Waxing	5362	5751	5.35	5352	5668	1.78
Full moon day	420	6059	5.60	421	6044	2.06
Waning	5325	5654	5.27	5291	5707	1.82
Total	11,437		5.32	11,393		1.81
Significance		.060			.063	

Table 3. Results for pain interference with sleep and side effect drowsiness.

Phase	Interference with sleep			Side effect drowsiness		
	N	Mean rank	Mean	N	Mean rank	Mean
New moon day	327	5507	2.85	325	5177	2.33
Waxing	5262	5669	3.04	5330	5724	2.86
Full moon day	415	5927	3.22	420	5885	3.01
Waning	5199	5515	2.89	5264	5629	2.79
Total	11,203		2.98	11,339		2.82
Significance		.012			.007	

the 0–10 NRS is presented. Neither maximal pain nor nausea shows significance in a Kruskal–Wallis test. The mean ranks differ only slightly between the four phases. The same holds for the mean values, which show deviations of below 0.4. Table 3 presents the same for the two items with significant differences between the phases, that is, pain interference with sleep and side effect drowsiness. Pain interference with sleep is highest on the full moon day (3.22) and lowest on the new moon day (2.85) and in the waning phase (2.89). Side effect drowsiness is also worst on the full moon day (3.01) and best on the new moon day (2.33).

The picture is different when we look upon the gender sub-groups. For women, only 1 in 14 items, that is, 'time in severe pain', results in significant differences between lunar phases (means: new moon 3.28, waxing 2.92, full moon 2.56 and waning 2.74). For men, 7 out of 14 items show significant differences between lunar phases (see Table 1). For most items, the full moon day is worst and the new moon day is best. The differences between the means of those two phases range from 0.4 to 1.18 on a 0–10 NRS. The differences between the waxing and the waning phase are always below 0.15.

As seen in Table 1, patients who are 55 years old or younger do not show a significant difference between lunar phases in any item. In contrast, patients who are older than 55 show a significant difference for the four items: worst pain, pain interference with sleep, nausea and drowsiness. For the last three items, full moon day is worst and new moon day is best with differences in means of 0.56, 0.76 and 0.86, respectively. Worst pain is an exception: full moon day is still worst (mean 6.02) but waxing (5.58) and waning phases (5.49) are both better than new moon day (5.67).

If only one type of surgical procedure is observed, no items show significant differences between lunar phases. However, the number of patients is relatively low for the single-day lunar phases then.

Discussion

In this retrospective study, the hypothesis that lunar phases have no effect on the observed surgical outcomes holds in general. But we must admit that it is not completely true. There are few items and specific patient sub-groups that indeed show a statistical connection to the phase of the moon. However, since we tested a lot of items, we expected about 6 out of 112 items to be significant just by chance due to the 5% significance level.

Looking at all patients, lunar phases have almost no effect. Out of 14 items, 12 are unaffected by the lunar phase. The only items that show statistically significant differences are pain interference with sleep and drowsiness. The latter might thereby be just a result of the previous since bad sleep could easily result in drowsiness afterwards. Slightly worse sleep on full moon day itself is not such a big surprise. It sounds logic that people sleep worse on full moon day. However, we have not found good studies that confirm this belief.

Anyway, the differences of means on the NRS are relatively small and clinically not important. The only real outlier is the reduced drowsiness on new moon day, which is 0.5 better than the mean. But even this is a clinically small difference.

We also do not find meaningful differences for women, young patients or looking at specific surgeries. The lone sub-groups that have a larger number of significant phase differences are men (7 of 14 items) and elderly patients (4 of 14 items). The previous is quite interesting as the lunar phase believers' society rather relates lunar impact on women than on men. This is because women have a menstruation cycle that shares timing similarities with the lunar cycle. However, for almost all items where men show significant phase differences, the claim of Paungger and Poppe[10] that full moon day is worst actually holds. Interestingly, the only significant item in women shows the exact opposite as new moon day is worst and full moon day is best. In contrast to the 'truth' about new and full moon, the proclaimed difference between the waxing and the waning phase cannot be observed in any sub-group or item. The results of Ficklscherer et al.[14] were repeated here as post-operative nausea in general is not higher in a specific moon phase.

All in all, the proclaimed differences in surgical outcomes between lunar phases can be seen as non-existing. Of the 112 item/sub-group combinations, only 14 showed statistical significance. And even in these items and sub-groups, the clinical relevance is very low as the differences in the means are still small on the NRS. The statistical significances settle mainly on the high number of patients as large groups sometimes lead to statistical significance without showing large differences in the observed values. Thus, none of the results would justify delaying or skipping surgeries because of the moon phase. Paungger and Poppe's claim is simply wrong.

Two shortcomings of this study design have to be mentioned. First, the different number of days that are compared is a disadvantage as the patient numbers differ largely between the phases with 1 day and the phases with more days. It would also have been possible to group patients more evenly by defining the phases to be around 1 week, respectively, or to use just 1 day for each phase. These options were discarded because the references' statements that shall be investigated in this article (especially May et al.[13]) speak of new moon day, full moon day and phases. A second flaw is the design of PO data collection. In PO, data are normally collected from Tuesday to Friday. This is because of the usual working times of data collectors and the rareness of surgeries on Sundays, which makes finding suitable patients on Mondays difficult. The result of this data collection weekdays is that we have less than 10 patients for 9 of the 25 new moon days and for 9 of the 24 full moon days in 2010 and 2011.

Conflict of interest

The authors declare that there is no conflict of interest.

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