



Introduction

Chiari I decompression (C1D) is a common pediatric neurosurgical procedure. Inpatient C1D postoperative care is often notable for pain and poor activity. Initiation of rehabilitation therapies, including physical, occupational, massage, and recreational, may impact recovery, but published evidence is scant.

Methods

An electronic medical record query by CPT code identified all patients who underwent C1D at our pediatric tertiary-care hospital from January 1, 2012 through February 20, 2016. Chiari II, redo C1D, and unrelated foramen magnum decompression operations were excluded. Demographic, financial, surgical, therapy, pain, and outcome data were analyzed.

Results

The study population (Table 1) included 59 patients with a mean age of 11-years-old (range 1-18), gender distribution of 56% male, and mean body mass index of 20.4. Sixty-one percent (36/59) had private insurance and 39% (23/59) had public insurance. C1D was intradural in 75% (44/59) with a mean surgery duration of 4.4 hours, and extradural in 25% (15/59) with a mean surgery duration of 2.4 hours. Seventy-three percent of patients (43/59) received at least one form of rehabilitation therapy. The mean postoperative pain score was 5/10 with acetaminophen, benzodiazepines, and narcotics used most frequently for pain control (Table 2). There was no apparent association between therapy and pain score or pain medication use. Table 3 details inpatient length of stay (LOS), cost of hospitalization, reoperation rate for surgical complication, and readmission rate within 30 days for each group. Public insurance was associated with a higher reoperation and readmission rate than private insurance. Intradural surgery was associated with a greater LOS, cost, reoperation rate, and readmission rate than extradural surgery. Having received any rehabilitation therapy was associated with an increased LOS and cost compared with no therapy, even when stratified for intradural versus extradural surgery, but a lower readmission rate. An association of therapy with reoperation rate was less distinct.

| Patient Group | No. of Patients | Pain Score | Acetaminophen | Ibuprofen | Ketorolac | Steroids* | Benzodiazepines** | Narcotics*** |
|----------------------------|-----------------|------------|---------------|-----------|-----------|-----------|-------------------|--------------|
| All patients | 59 (100%) | 5 (2) | 28 (14) | 17 (7) | 1.0 (0.3) | 1.8 (1.0) | 0.9 (0.5) | 0.3 (0.2) |
| Private insurance | 36 (61%) | 4 (2) | 30 (12) | 18 (7) | 4.0 (2.0) | 1.9 (1.5) | 0.9 (0.5) | 0.3 (0.1) |
| Public insurance | 23 (39%) | 6 (2) | 27 (16) | 14 (7) | 1.0 (0.3) | 1.5 (N/A) | 0.9 (0.5) | 0.3 (0.2) |
| Intradrug surgery | 44 (75%) | 5 (2) | 28 (14) | 17 (7) | 1.0 (0.3) | 0.9 (0.3) | 0.7 (0.4) | 0.3 (0.1) |
| No therapy | 11 (19%) | 6 (3) | 20 (10) | 13 (6) | 0.7 (0.3) | n/a | 0.6 (0.5) | 0.3 (0.1) |
| Any therapy | 33 (56%) | 5 (2) | 31 (15) | 19 (7) | 0.9 (0.3) | 1.8 (1.0) | 0.8 (0.4) | 0.3 (0.1) |
| Extradrug surgery | 15 (25%) | 5 (3) | 28 (12) | 16 (8) | 0.7 (0.5) | n/a | 1.4 (0.7) | 0.2 (0.1) |
| No therapy | 5 (8%) | 4 (3) | 35 (15) | 13 (n/a) | 0.8 (0.7) | n/a | 1.5 (1.0) | 0.2 (0.1) |
| Any therapy | 10 (17%) | 5 (3) | 25 (9) | 17 (8) | 0.6 (n/a) | n/a | 1.3 (0.6) | 0.3 (0.1) |
| No therapy | 16 (27%) | 5 (3) | 13 (24) | 13 (13) | 0.7 (0.4) | n/a | 0.9 (0.8) | 0.2 (0.1) |
| Any therapy | 45 (73%) | 5 (2) | 30 (14) | 18 (7) | 0.9 (0.3) | 1.8 (1.0) | 0.9 (0.5) | 0.3 (0.1) |
| Cervical range of motion | 40 (68%) | 5 (2) | 30 (13) | 19 (7) | 0.9 (0.3) | 1.8 (1.0) | 0.9 (0.5) | 0.3 (0.1) |
| Amputation | 34 (58%) | 5 (2) | 29 (14) | 19 (7) | 1.0 (0.4) | 2.3 (1.0) | 0.9 (0.4) | 0.3 (0.1) |
| Activities of daily living | 5 (8%) | 6 (3) | 36 (10) | 20 (2) | 0.9 (0.4) | 1.9 (1.5) | 1.0 (0.4) | 0.3 (0.1) |
| Massage | 13 (22%) | 4 (2) | 29 (11) | 19 (6) | 0.7 (0.1) | 2.2 (1.0) | 0.9 (0.3) | 0.3 (0.1) |
| Recreational | 3 (5%) | 4 (2) | 28 (10) | 20 (4) | n/a | n/a | 1.3 (0.2) | 0.3 (0.1) |

* Hydrocortisone equivalents
 ** Lorazepam equivalents
 *** Morphine equivalents

| Patient Group | Number of Patients* | Inpatient Length of Stay in Days (Mean) | Total Cost of Hospitalization (Mean, SD) | Reoperation for Surgical Complication* | Readmission Within 30 Days* |
|----------------------------|---------------------|---|--|--|-----------------------------|
| All patients | 59 (100%) | 4.0 | \$40,897 (\$12,639) | 4 (7%) | 5 (8%) |
| Private insurance | 36 (61%) | 4.1 | \$49,017 (\$11,090) | 1 (3%) ^a | 1 (3%) ^a |
| Public insurance | 23 (39%) | 3.9 | \$51,235 (\$14,855) | 3 (13%) | 4 (17%) ^a |
| Intradrug surgery | 44 (75%) | 4.2 ^b | \$52,093 (\$12,972) | 4 (9%) | 5 (11%) |
| No therapy | 11 (19%) | 3.5 | \$46,247 (\$19,949) | 1 (9%) | 2 (18%) |
| Any therapy | 33 (56%) | 4.5 | \$54,103 (\$9,127) | 3 (9%) | 3 (9%) |
| Extradrug surgery | 15 (25%) | 3.4 ^b | \$43,599 (\$9,394) | 0 (0%) | 0 (0%) |
| No therapy | 5 (8%) | 2.8 | \$38,407 (\$3,080) | 0 (0%) | 0 (0%) |
| Any therapy | 10 (17%) | 3.7 | \$46,194 (\$10,516) | 0 (0%) | 0 (0%) |
| No therapy | 16 (27%) | 3.3 ^c | \$43,797 (\$16,791) | 1 (6%) | 2 (13%) |
| Any therapy | 45 (73%) | 4.3 ^c | \$52,220 (\$9,043) | 3 (7%) | 3 (7%) |
| Cervical range of motion | 40 (68%) | 4.2 | \$51,756 (\$9,937) | 3 (8%) | 3 (8%) |
| Anbulation | 34 (58%) | 4.1 | \$50,919 (\$9,859) | 1 (3%) | 1 (3%) |
| Activities of daily living | 5 (8%) | 5.9 | \$63,771 (\$11,780) | 0 (0%) | 0 (0%) |
| Massage | 13 (22%) | 3.9 | \$52,229 (\$9,011) | 2 (15%) | 2 (15%) |
| Recreational | 3 (5%) | 5.2 | \$64,164 (\$4,052) | 0 (0%) | 0 (0%) |

Conclusions

In our population, rehabilitation therapy was associated with an increased inpatient LOS and cost but a lower readmission rate. It is possible that the initiation of therapy was a marker for a more symptomatic child who would require more time to recover. It is also possible that the lower readmission rate related to an increased discharge readiness among the therapy group. Further investigation is ongoing.

| Patient Group | Number of Patients* | Patient Age in Years (Mean, Range) | Male Gender* | Body Mass Index (Mean, SD) | Private Insurance* | Intradural Surgery* | Surgery Length in Hours (Mean, SD) |
|----------------------------|---------------------|------------------------------------|--------------|----------------------------|--------------------|---------------------|------------------------------------|
| All patients | 59 (100%) | 11 (1-18) | 33 (56%) | 20.4 (5.3) | 36 (61%) | 44 (75%) | 3.9 (1.4) |
| Private insurance | 36 (61%) | 11 (1-18) | 18 (50%) | 20.5 (5.3) | 36 (100%) | 26 (72%) | 3.5 (1.2) |
| Public insurance | 23 (39%) | 11 (1-18) | 15 (65%) | 20.4 (5.3) | 0 (0%) | 18 (78%) | 4.1 (1.5) |
| Intradural surgery | 44 (75%) | 11 (1-18) | 23 (52%) | 20.2 (5.3) | 26 (59%) | 44 (100%) | 4.4 (1.2) |
| No therapy | 11 (19%) | 9 (1-18) | 8 (73%) | 19.0 (5.2) | 7 (64%) | 11 (100%) | 4.1 (1.2) |
| Any therapy | 33 (56%) | 11 (3-18) | 15 (45%) | 20.6 (5.3) | 19 (58%) | 33 (100%) | 4.5 (1.2) |
| Extradural surgery | 15 (25%) | 11 (1-18) | 10 (67%) | 21.0 (5.5) | 10 (67%) | 0 (0%) | 2.4 (0.8) |
| No therapy | 5 (8%) | 9 (2-17) | 3 (60%) | 17.8 (3.1) | 4 (80%) | 0 (0%) | 2.5 (0.8) |
| Any therapy | 10 (17%) | 12 (1-18) | 7 (70%) | 22.5 (5.9) | 6 (60%) | 0 (0%) | 2.4 (0.8) |
| No therapy | 16 (27%) | 9 (1-18) | 11 (69%) | 18.7 (4.6) | 11 (69%) | 11 (69%) | 3.6 (1.4) |
| Any therapy | 43 (73%) | 12 (1-18) | 22 (51%) | 21.0 (5.4) | 25 (58%) | 33 (77%) | 4.0 (1.4) |
| Cervical range of motion | 40 (68%) | 11 (1-18) | 20 (50%) | 20.9 (5.4) | 23 (58%) | 31 (78%) | 4.1 (1.4) |
| Ambulation | 34 (58%) | 12 (3-18) | 18 (53%) | 21.3 (5.5) | 20 (59%) | 26 (76%) | 3.9 (1.4) |
| Activities of daily living | 5 (8%) | 12 (9-16) | 0 (0%) | 22.1 (1.9) | 5 (100%) | 5 (100%) | 2.7 (0.5) |
| Message | 13 (22%) | 14 (8-18) | 7 (54%) | 24.1 (5.3) | 7 (54%) | 11 (85%) | 4.2 (5.3) |
| Recreational | 3 (5%) | 9 (5-13) | 1 (33%) | 20.6 (4.2) | 3 (100%) | 2 (67%) | 2.7 (0.5) |

* Percentage in Number of Patients column is of n=59; Percentage in other columns is of Number of Patients for that row