Case Series

Coccyx Fractures Treated with Intranasal Calcitonin

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Background: Treating pain associated with acute coccyx fractures can be challenging. Intranasal calcitonin has been used to treat acute pain after vertebral fracture, and may even accelerate fracture healing. However, intranasal calcitonin has never previously been published as part of the treatment of acute coccyx fractures.

Objective: To examine a series of cases in which intranasal calcitonin was used to treat coccydynia related to coccyx fractures.

Study Design: Case series and literature review.

Setting: Outpatient university-based coccyx pain center.

Results: After use of intranasal calcitonin, pain levels decreased, adverse events were minimal, and the medication was generally well tolerated.

Limitations: As this is not a randomized control trial, the patients treated with intranasal calcitonin were not compared to a control group. Additionally, the sample size of 8 patients is relatively small.

Conclusions: We propose that clinicians consider use of intranasal calcitonin for the treatment of pain due to acute coccyx fractures.

Key words: Coccyx, fractures, calcitonin, pain

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Salmon calcitonin (SCT) has been an available therapeutic agent for over 30 years. In the United States intranasal calcitonin (Fortical, Miacalcin) is currently FDA approved for the treatment of postmenopausal osteoporosis in women greater than 5 years postmenopause with low bone mass relative to healthy premenopausal women. The injectable form of calcitonin (Miacalcin) administered either subcutaneously or intramuscularly is currently FDA approved for the treatment of symptomatic Paget's disease of bone, hypercalcemia, and postmenopausal osteoporosis. However, approved indications vary by country (1).

The analgesic properties of SCT have been documented in several prospective clinical trials (2-5). Studies that compare the analgesic effects of the nasal spray against the injectable SCT in vertebral fractures appear to show no difference between the two (6,7). While the exact mechanism has yet to be fully elucidated, previous studies show calcitonin effects include β-endorphin production, inhibition of both prostaglandin and cytokine production, and pain perception modulation through a central mechanism involving serotonergic pathways (1,5).

Numerous studies and reviews show that SCT has been used effectively to treat pain of varying neuro-

logic and musculoskeletal etiologies including Paget's disease (8), acute osteoporotic vertebral fractures (3,9), total hip arthroplasty (THA) (10), and acute post-operative phantom limb pain (11,12). Case studies have also documented potential analgesic benefits of SCT in rib fractures (13), post-herpetic neuralgia (14), chronic sclerosing osteomyelitis of the mandible (15), and the management of acute neuropathic pain associated with spinal cord injury (16). There are conflicting results of efficacy with complex regional pain syndrome (17-20) and metastatic bone pain (21-24).

SCT may have a positive effect on fracture healing. In a rat model, improved fracture healing was seen in a group receiving intramuscular calcitonin as compared to controls (25). In a study of patients with acute hip fracture after internal fixation, there was improved fusion in those using intranasal calcitonin, compared to placebo (26). Intranasal SCT also seems to help the healing of fractured odontoid bones (27,28).

Furthermore, the documented adverse effects of intranasal calcitonin are usually mild and self-limiting, often consistent with increased serotonergic activity (11,16,29). Systemic side effects like flushing, nausea, and diarrhea are rarely seen with the nasal spray, but are not uncommon with the injectable forms. The most frequent adverse events involve local (nasal) transient reactions, including nasal passage tingling or stinging, nasal mucosal erythema, occasional minor bleeds, rhinitis, and sneezing. The only contraindication to intranasal SCT is a known hypersensitivity, usually seen in patients with allergies to salmon or seafood. If suspected, reactivity can be assessed via skin testing prior to the first administration (1).

We could not find any literature discussing intranasal SCT as a therapeutic agent for coccydynia secondary to coccyx fracture. Acute coccydynia is often caused by a traumatic event, such as a fall in the seated position, with the most frequent accident mechanism being axial impact to the most distal part of the spine, or while giving birth. Chronic coccydynia is generally caused by repetitive microtraumas, such as those incurred with cycling, rowing, or poor seating posture (30,31).

We hypothesized that intranasal SCT may be an effective medication to treat patients with coccydynia due to coccyx fracture because of its analgesic properties, potential fracture healing properties, ease of administration allowing for improved compliance, and relatively safe side effect profile.

Intranasal SCT for Coccydynia: Case Report

Patients treated with Intranasal SCT < 3 months from fracture

1. A 29-year-old female fell backwards down stairs, landing on her tailbone repeatedly. Diclofenac provided minimal relief. X-rays showed an acute transverse fracture through the first coccygeal segment, an anteriorly displaced distal fracture fragment, and small bone fragments posterior to the distal fracture fragment. Fourteen days after fracture she was started on intranasal SCT (200 IU daily) and oxycodone/acetaminophen 5mg/325mg 4 times daily as needed, but stopped taking Percocet due to nausea. Pain decreased from 7/10 to 3/10 by day 37. Intranasal SCT was discontinued by patient after 3 months because the 3/10 pain plateaued. No medication side effects were documented.
2. A 66-year-old female fell on her tailbone while attempting to sit in a chair. X-rays showed a fracture through the first coccygeal segment and possible fracture at the upper quarter of the C2 segment. Four days after fracture she was started on intranasal SCT (200 IU daily), which was continued for 11 weeks, and oxycodone/acetaminophen 5mg/325mg 4 times daily as needed, which she began tapering after 24 days. Pain decreased from 6 – 7/10 to 1.5/10 on average after 11 weeks. No medication side effects were documented.
3. A 59-year-old female experienced a syncopal episode causing her to fall onto her tailbone. X-rays showed a sub-acute C1 compression fracture and abrupt angulation of C1-C2 with a widened joint space. Four weeks after the fracture she was started on intranasal SCT (200 IU daily) and tramadol 50mg 4 times daily as needed. After 2 weeks, the pain decreased from 10/10 to 8/10, but was still severe enough to require undergoing coccyx somatic nerve block and steroid injection. No medication side effects were documented.
4. A 63-year-old female slipped on a wet floor and landed on her tailbone. X-ray showed compression fracture at the lower third of the second coccygeal segment and dynamic instability. Five days after fracture patient was started on intranasal SCT (200 IU daily) and tramadol 50mg 4 times daily as needed. Pain decreased from 9/10 to 6/10 after a month course. No medication side effects were documented.

5. A 51-year-old female nurse that fell on her tailbone while attempting to sit in a chair. X-ray showed a fracture at the second coccygeal segment and retrolisthesis of the third coccygeal segment with respect to the fourth. Ten days after the fracture the patient was started on intranasal SCT (200 IU daily) and was instructed to continue tramadol, although she discontinued tramadol due to side effects. Pain decreased from 6/10 to 2.5/10 after 10 days of treatment with intranasal calcitonin. No medication side effects were documented.

Patients treated with Intranasal SCT > 3 months from fracture

6. A 63-year-old male fell off a 10 foot ladder onto his tailbone. He presented to our office 24 weeks after injury, and at that time X-rays showed comminuted fracture at the first coccygeal segment and a healing fracture at the second coccygeal segment. Intranasal SCT (200 IU daily) was started and a ganglion impar injection was done. Pain decreased from 6/10 to 1/10 over the subsequent 5.5 months. No medication side effects were documented.
7. A 24-year-old female slipped while running and forcefully fell directly onto her tailbone. MRI showed anterior subluxation of the first and fourth coccygeal segments and fracture of the third segment. After a somatic nerve block with steroid injection and sympathetic nerve block with steroid injection, pain decreased to 3/10, but continued to compromise her quality of life and ability to work. Intranasal SCT (200 IU daily) was started 6 months after the injury. No medication side effects were documented. Patient was subsequently lost to follow-up.
8. A 51-year-old female slipped and fell on concrete 22 months before arriving to our office. An MRI done 2 months after the fall showed a distal coccyx bone spur vs. posteriorly displaced fracture and increased T2 signal intensity. Hydrocodone/acetaminophen 7.5/500mg and tramadol/acetaminophen 37.5/325mg had provided minimal benefit. Her pain was 10/10 on initial visit to our office. Intranasal SCT (200 IU daily) was started and continued for 3 – 4 weeks, but was discontinued by the patient after no effect on pain and after developing nostril irritation and nose bleeding. Patient subsequently underwent coccyx steroid injection and sympathetic (ganglion impar) coccyx nerve blocks.

Discussion

As seen in our results, 3 of the 5 patients that were seen within 3 months of experiencing coccydynia (acute) secondary to coccyx fractures received at least a 50% improvement in pain while using intranasal SCT with or without opioid medications, and without invasive interventions like coccyx injections or surgery. One of the 3 patients that were seen after 3 months of experiencing coccydynia (chronic) secondary to coccyx fractures had at least a 50% improvement in pain while using intranasal SCT and after receiving a coccyx injection. A 50% improvement in pain has been considered by some studies as a favorable outcome (32). Comparing the former outcomes to the latter, the latter patients were unable to obtain relief with medications alone and needed further interventions including coccyx injections. These findings suggest that intranasal SCT may be beneficial to treat acute coccyx fracture related pain, but less beneficial for painful coccyx fractures that are more chronic.

The published medical literature has never before addressed the consideration of intranasal SCT as part of the treatment of acute coccyx fractures. The 2 therapeutic goals when using intranasal SCT in patients with acute coccyx fracture are analgesia and improved fracture healing.

Admittedly, there are some notable differences between using intranasal SCT to treat acute coccyx fractures compared with using it as it is currently indicated by the FDA for osteoporosis, which may include osteoporotic vertebral compression fractures. Compression fractures in the thoracic and lumbar spine often occur in postmenopausal osteoporotic women in the absence of substantial acute trauma. Conversely, coccyx fractures are typically the results of acute, abrupt trauma, regardless of gender, and regardless of whether the patient is postmenopausal or osteoporotic. Thus, if intranasal SCT only works via mechanisms uniquely helpful in osteoporotic fractures, then it would not be expected to be useful in traumatic fractures in patients with normal bone mineral density. Unfortunately, there is no literature, to our knowledge, that evaluates the efficacy of SCT to treat trauma related fractures in normal bone except for our results above.

There have been several double-blind, randomized prospective studies that have demonstrated the analgesic effect of SCT in patients suffering from acute post-fracture vertebral pain (2-5). Moreover, a systemic review and meta-analysis by Knopp-Sihota et al (33) showed that SCT was effective in treating acute pain

(pain < 3 months) in patients suffering from osteoporotic vertebral compression fractures. However, SCT was ineffective in treating chronic pain (pain > 3 months) in this setting. These results seem to coincide with our results. Additionally, there have been multiple studies that have shown SCT to be beneficial in significantly decreasing fracture pain at sites outside the vertebral column (10,13,21-23).

Furthermore, initially after an acute fracture, many physicians avoid prescribing oral anti-inflammatories, such as NSAIDs, since fracture healing reportedly involves an inflammatory phase which is necessary for optimal recovery (34,35). As discussed earlier, intranasal SCT has significant analgesia properties and may also accelerate fracture healing, making it an ideal medication to treat coccydynia secondary to coccyx fracture, particularly given the need to avoid NSAIDs during this time.

Regarding risks/benefits, the risks of treatment seem acceptable. Administration is typically easy and painless, with one spray per day given into a single nostril (to the contralateral nostril on alternating days). The aforementioned side effect profile suggests medication that is well tolerated. Of the patients we saw, only 1 of the 8 patients had a side effect, nasal irritation and bleeding, that caused her to stop the medication.

Recently, the European Medicines Agency (EMA) published a press release stating that in long-term clinical trials, the risk of developing cancer was 0.7% to 2.4% higher in patients receiving SCT-containing medicines compared to those receiving placebo (36). However, the EMA did not advise against short-term use (less than 3 months), and there is no current research showing increased risk of cancer with short-term use of SCT. Given that the analgesic properties of SCT are only beneficial for acute pain (33), with treatment usually limited to 4 – 6 weeks (7), this new information does not necessarily affect our proposed short-term use.

Meanwhile, there are significant benefits to be gained by the use of short-term intranasal SCT in patients with acute coccygeal fractures — pain relief and potentially faster bone healing. Pain relief is crucial in these patients given the severe nature of coccyx pain, the way such pain substantially compromises patient quality of life, and the tendency of coccyx pain to become chronic and disabling.

While this paper demonstrates a potentially important use of intranasal SCT, there are 2 limitations to this case series that should be considered. Firstly, as this is a case series and not a randomized control trial, the patients treated with intranasal calcitonin were not compared to a control group. Secondly, despite having reviewed 800 charts, there were a relatively small number of patients with coccydynia secondary to a coccyx fracture. Only patients with a confirmed coccyx fracture were treated with intranasal SCT in this review.

Conclusions

The use of intranasal SCT in the treatment of acute coccyx fractures has not been previously reported. Based on our experiences outlined in this case series and based on the volume of literature that has documented the analgesic efficacy of intranasal SCT in a variety of neurologic and musculoskeletal conditions, we propose that clinicians consider using intranasal SCT for the treatment of pain in acute coccyx fractures. Treatment should be limited to the shortest possible time using the smallest effective dose. Given that there was no control group in this case series, prospective randomized controlled studies are important in further defining the role of intranasal SCT in acute coccyx fractures.

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