Aetiological factors of back pain in helicopter flying

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The frequency and the nature of low-back pain among helicopter and turbo prop aircrew in the RNAF were assessed through questionnaires. As expected, the helicopter crew had by far the highest incidence of back pain, but with marked differences among the various helicopters (Sea King, Bell 412, Lynx). The reasons for this are discussed. The two most widely implicated aetiological factors in back pain problems are poor posture and vibration. In this investigation the pilots and the other crew members reported separately. Only the helicopter pilots had a high incidence of back pain, whereas the engineers, sitting next to the pilots, reported back pain the prevalence of which was not more than the normal population. We conclude that back pain among helicopter pilots is related to poor posture, whereas vibration plays a minor, if at all any, role. Measures to reduce back pain are suggested.

Keywords: Backpain; Helicopter pilots; Posture

Complaints about low-back pain (LBP) are a well-known amongst aviators. Helicopters have especially been associated with a high incidence of such pain. Previous surveys have indicated that up to 75% of the helicopter aircrews complain of this affliction, and that LBP has a significant effect both on manpower availability and on mission performance.

The Royal Norwegian Air Force has a helicopter fleet consisting of Westland Sea Kings (SKs), Bell 412 and Westland Naval Lynx. All operate under a number of different conditions. The SKs are stationed along the coast and operate, to a large extent, over the North Sea and the Barents Sea. Their primary role is to search and rescue, often in bad weather, and the missions can last for many hours. The Bell 412 operates mostly over land on shorter missions than the SKs. The Lynx operates from coast guard vessels in the northern waters. Almost 24 h darkness during the winter months adds considerable difficulties in operating over sea. The durations of the missions are, however, shorter than those of the SKs and the Bells.

This survey is aimed at establishing the size of the low back pain problem in the Norwegian Air Force and the extent to which LBP had an effect on the quality of the work done during the mission.

Aircrew flying Twin-otter and C-130 Hercules transport aircrafts, and Lockheed P-3 Orion turbo prop aircraft were also assessed using the same questionnaire.

Surveillance missions as a control group

The crew members (204 in all) were asked about the incidence and/or flight-related low back pain during the last 2 years.

The incidence of low back pain among fixed-wing aircrew is comparable to the common population in Norway. The incidence among helicopter aircrew is, on the other hand, definitely above the expected level and also significantly above that of fixed-wing crews. Analysing the performance in relation to LBP shows that almost 65% of the SK crews, 44% of the Bell crews and 31% of the Lynx crews reported LBP. Both the SKs and the Bells rank high.

When aircrew were asked as to what they considered to be the main reason for the high incidence of LBP, most blamed the construction of the seats.

From May 1993 until the end of the year we asked the crews to report back after each mission whether or not any member of the crew had felt LBP during the flight, and, if so, to fill out a more detailed questionnaire.

Analysis shows that aircrew in 330 Squadron flying SKs reported almost 50% LBP incidents.

The 720 Squadron crew flying Bell 412 reported 17%, the 339 Squadron crew flying Bell only 4% and the 337 Squadron crew flying Lynx 14%. This somewhat confusing result may be explained on the basis of the durations of the flights. The SKs which have both bad seats and also long missions over sea have, as can be expected, the highest incidence of LBP. The 720 and the 339 Squadron crew both flying the same type of aircraft show different results. This cannot be explained by looking at the flight time, however; the 339 Squadron is mainly engaged in troop transport. During a mission they will make one or more stops. The time they spend in the air is shorter than that spent by the 720 Squadron crew, which has many search and rescue missions in the more densely populated areas of southern Norway.

From other surveys there are indications that a flight has to be of more than 1.5 h duration to cause LBP. The 339 Squadron crew has a total flying time longer than that, but taking the stops into account they do, in fact, have an average flight time of less than 1.5 h. The 720 Squadron crew has twice that time.

The 337 Squadron crew flying mostly from coast guard ships, has an average flight time of 2.3 h – somewhat less than that of the 720 Squadron crew flying Bell 412 helicopters. Our conclusion is that flight time is an important factor in the LBP-syndrome and that a flight time of around 1.5 h seems to be a critical point. This corresponds well with the results of other surveys.

From everyday life we all know that back pain can affect our work performance. Those who reported back pain were asked if this affected the quality of their work. Almost half said 'no' and the other half said 'a little'. None felt that LBP had a great influence on their performance. We have not gone into further details on this.

Vibration has been looked upon as the most probable cause of LBP in helicopter aircrew. There is, however, much uncertainty about the role of vibration in causing LBP.

In our survey all crew members reported individually. For simplification we have divided them into two groups consisting of pilots and all other crew members. From the number of reports we see that an overwhelming majority of LBP-sufferers are the pilots. If vibration played an important role in the cause of LBP, not just the pilots but also their fellow crew members sitting next to them should have reported this. Our conclusion is that vibration is not an important factor in the LBP syndrome in helicopters.

How then is the difference between the crew members to be explained since they sit in the same kind of seat and fly the same mission? We believe that the pilot has a more complex task to perform. He is constantly working with both arms and legs, with little chance to rest while flying, in contrast to the engineer and other crew members. He is often forced to sit bent forward with little chance to rest in a good posture. Almost all the crew members themselves blamed bad seat construction for the back pain. The seats of both the SK and the Lynx lack a good lumbar support and the SK has, in addition, a metal frame around the seat which crosses at the level of the back of the head or neck.

During flight, the helmet often comes to rest on this frame part, which transfers the vibration in the aircraft onto the helmet. In addition, heavy life vests worn around the neck in the SK and Lynx causes extra strain. The seats in the Bell 412 have a lumbar support, but the seat is otherwise not adjustable and complaints about the thighs not being supported is common. Any modern car has better seats than these multimillion dollar aircraft.

How then can we reduce the LBP incidence in helicopter aircrew to an acceptable level? Obviously, we have to do something about the seats. Much better seats than those described here are used in the civilian helicopters in Norway. This seat has an adjustable lumbar support and adjustable thigh and head/neck supports. The angle between the back and the bottom of

the seat is also adjustable. Armrests are not practical in all aircraft, but in the next-generation fly-by-wire helicopters they can easily be fitted. These are definitely better seats than our present seats in the Norwegian Air Force and would probably reduce the LBP incidence significantly if and when they are introduced. Putting new seats into the existing helicopter fleet is a question of money and priorities. At a time when the budgets are reduced, this is not easy.

Another practical solution for the period until the new generation of helicopters are introduced could be an individually fitted lumbar support (already in use in the RAF). Here a mould is made of the lumbar back of the airman when sitting in a testchair. From this mould a lumbar support is made and this is worn outside the flight suit. Those responsible for this programme in the RAF claim that up to 80% get a total or considerable relief from lumbar pain through this simple measure.